

Aviation Week

Including Space Technology

April 13, 1959

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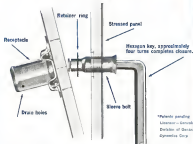
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Goodrich Anti-Skid System is non-essential to normal aircraft operation. It is required by military and commercial pilots. FAA-approved for Douglas DC-7B and DC-7C aircraft. Goodrich Anti-Skid System—proven test results for the Convair 440 and Republic P-105.



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AVIATION WEEK, April 13, 1959



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[illegible]

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출판일: 2017년 12월 15일

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AVIATION CALENDAR

(Continued from page 53)

- [illegible]

GPL systems management
equipment for the Federal Aviation Agency

[illegible]

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SUBJECT: — SPL #0896-02 files serial as above subject interest and background information. See memo to Personnel Chief.



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Autonetix



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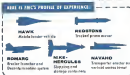
Whether it is highly complex missile surface handling equipment, like the giant FMC-designed Thor transporter-erector and launching base—or small, compact mobile missile equipment, FMC provides complete capabilities with fully integrated facilities for the entire project. Coordinated control of each phase of the job from design concept through development, engineering and production, enables FMC to meet contract delivery requirements—an schedule.

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Mobile Equipment Division
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AVIATION WEEK, April 13, 1957





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The Air Proving Ground Center, located at Eglin Air Force Base, Florida, is one of the test and development centers of the air armance and development commands of the USAF. As part of its overall mission, APGC is responsible for research, development, test, and evaluation of guns and other aircraft weapons, ammunition, rockets, bombs (except nuclear weapons), fire control components and systems. Typical of the development programs being conducted by APGC is the TDU-8/B supersonic tow target. This unique target, designed and produced by Hayes Aircraft Corporation, provides year-ahead capability to the Air Force in the training of personnel in military, rocketry, and modern gunnery.

The TDU-8/B target provides realistic simulation of full scale aircraft and missiles. Constructed of sturdy reinforced plastics, the target contains equipment for a number of specialized missions. Included in this equipment are a scoring device, radar tracking beacon, radar augmentation, infrared radiation augmentation, visual augmentation, and a command receiver. The reliable recovery system insures reuse of the target and economical operation. The overall system reflects the technical team work between APGC and Hayes Aircraft Corporation.

The TDU-8/B tow target development is one of several contracts which Hayes Aircraft Corporation has with the Air Proving Ground Center. As such, it is another fine example of the Air Force-Industry team working towards a more secure America.

RESEARCH, DEVELOPMENT & TECHNICAL PERSONNEL are needed by Hayes Aircraft Corporation to participate in modern weapons system and component design and manufacture. With more than 10,000 employees, Hayes is currently active in both research and aircraft production and is expanding research and development in many diverse fields. We welcome your inquiries. For further details, write to Personnel Director, Department 405, P.O. Box 2287, Birmingham, Alabama.



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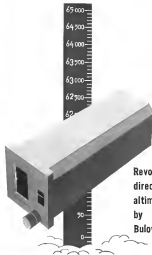


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Ryan Aeronautical Company, San Diego, Calif.

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Including Space Technology

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Monday, April 13, 1959

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COVER: Mercury man in space capsule is portrayed in silhouette with Earth at Langley Research Center (Va.) National Aeronautics and Space Administration, the study of its jet and other characteristics.

Oblique of the moon is shown in the background of the capsule, the study of its jet and other characteristics.

PICTURE GALLERY
Cover—Mercury man in space capsule is portrayed in silhouette with Earth at Langley Research Center (Va.) National Aeronautics and Space Administration, the study of its jet and other characteristics.

76,421 copies of this issue printed

General Power's Blunt Warning

The Fiscal 1968 Defense Department budget is risking the future of the United States by imposing fiscal limits on the technical, industrial and military capability of this country to modernize its strategic defense forces fast enough to maintain a continuous margin of significant superiority over Soviet military strength. This is the blunt warning recently sounded to Congress by Gen. Thomas S. Power, commander of Strategic Air Command (see p. 10).

Gen. Power is probably better qualified in modern military technology and the fast changing nature of the strategic defense equation than any other general, active or retired, in this country today. And he is the man who now has the ultimate responsibility to make good is seeing that our country can combat the pressures and threats made to the American people by political groups and general politicians.

Gen. Power was one of the first military men to work in constant with strategic weapons during his 3-25 command in the Pacific war against Japan. He has participated in the building of Strategic Air Command from its postwar inception and has served with it in various capacities for over 25 years. He also acquired a rare intimacy with the piloting new technologies and their critical time factors that new defense military operations during a first year launch is head of the Air Research and Development Command. He also was one of the first high level USAF officers to visit the Soviet Union and actually see its combat planes, aircraft and engine factories and technical schools and personally meet the men who run the vast Russian military program. Therefore, his analysis of the current and future problems of our strategic defense forces in relation to the Soviet Union carries special weight and deserves the detailed attention of the American people in formulating their decisions.

We would like to call special attention to several key points made by Gen. Power that go far to clearly what has been up to now a confusing welter of soothing syrup and glossy generalities dispensed by the Joint Chiefs of Staff during their Fiscal 1968 budget testimony.

These points include:

• The strategic deterrent of the United States today, of which 95% is carried in the bomb bays of Strategic Air Command B-47s and B-52s, has sufficient margin of superiority to deter the Soviet Union from major war now.

This is not the first at stake in the Fiscal 1968 defense budget.

The end and issue, according to Gen. Power—and we agree—is that, under the limitations imposed by the budget, our strategic defense posture is deteriorating in relation to the Soviet Union and will continue to do so unless those forces are modernized as fast as our abilities permit.

• This country has the technical, industrial and military

capability to modernize our strategic defense forces at a fast enough pace to maintain the required margin of superiority. "I want more B-52s than are in our program, and I want more Atlases and I want them faster and I want more B-51s. . . . I think you are just risking the whole country. That is how important I feel it is. If you do not deter this man (Nikolai Khrushchev) as I and before, nobody is going to win a thermonuclear war. . . . The door which is now progressing—which I am told by the Pentagon is progressing—is not adequate because it is not coming fast enough. I want more and I want it better. I have to say for it."

The details of how the B-52 and B-55 bomber production rates have been stretched out due to fiscal limitations and the KC-135 tanker program similarly reduced by budget cutbacks has been detailed in *Airweek* News before. Defense Secretary Melvin Laird confirmed to Congress recently that the Atlas KCMB production rate was being deliberately held to a fraction of its current capacity.

• The claim that it is possible to safely abandon significant margins of military superiority and maintain only a "perceived calculated" "minimum deterrent" is completely false.

"People sometimes ask me what I think the minimum deterrent force is," Gen. Power said. "They ask as though it were a package that one could get at a local store and buy it off the shelf with a price tag on it. I tell these people I don't know what the minimum deterrent is and what it costs them a nobody in this world who knows."

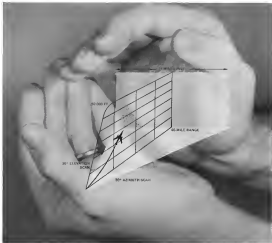
"If anybody tells you they know what the minimum deterrent is, tell them for me that they are lying."

"The closest man who would know what the minimum deterrent is would be Mr. Khrushchev and frankly I don't think he knows from one week to another. He might be willing to absorb more punishment and seek than he wants to absorb today. Therefore, deterrence is not a concrete or fixed amount."

• A relatively small percentage of the Defense Department's current budget is being devoted to Strategic Air Command. Gen. Power estimated that only 10% of the dollar, less than 50% of the man and mil costs and about 75% of the aircraft now in the defense establishment are in SAC.

There are only a few of the highlights in Gen. Power's testimony it is possible to discuss in this limited space. Consequently, we are publishing the text of Gen. Power's testimony before the House Appropriations Military Subcommittee on the April 20 issue of *Airweek* News. We recommend a detailed study of it to our readers as the clearest exposition to date of what the technical, military and fiscal problems is confronting an effective strategic defense to major war as far as it can be done as any man can now see.

—Robert Hottel



Gilfillan Quadrarad first proven navigational aid for the safe handling of supersonic jet aircraft!

Versatility and reliability of the Gilfillan Quadrarad has been proven for over two years in more than 150 countries around the world! Gilfillan Quadrarad has a three-dimensional approach and departure system 40 miles long, a 30-mile wide "gate" and altitude coverage of 50,000 feet to permit a complete air performance and safe high-angle climb-out.

Quadrarad's 160-degree surveillance and height-finder system permits night, light three-dimensional control of traffic patterns within an area of 5,000 square miles. Power can be uniformed of position of all other aircraft within the terminal area, reducing altitude hazards. Using its jet performance function in reverse, Quadrarad provides safe normal descent. Much also high-angle climb-out, even in high-density traffic. The versatility and terminal area safety features during penetration and

high angle, high-speed climb-out of jet aircraft have been established by the U.S. Navy, the U.S. Air Force and by Lockheed, Douglas, Convair, North American and Hughes Aircraft Companies in actual operations at Moffett NAB, Castle AFB, and at Edwards Flight Test Center. Quadrarad's unique versatility in providing air traffic controllers with accurate, reliable altitude separation, maximum TMAAN approach, climb-out, and multiple runway arrivals. It is also used in a low-level climb.

Quadrarad's multifunctional expansion port TPO and cruise capabilities in the fields of Air Navigation, Radar Training and Ground Support Equipment, Electronic Countermeasures, Missile Systems and its astronomical aid available for complete research, development and production in these and related fields.



new
THOMAS A.

EDISON

oil pressure
indicating system
withstands vibration
to 2000 cps at 20g's



Responsive to transient directly at engine and responds on panel indicator and gives alarm by 2 indicated engine warns.



Indicator is hermetically sealed—shows low oil pressure when pressure drops below set point and starts oil circulating (see diagram in TVE and at Edison office) data. Switching can may be long-life signal.

Designed for use on all new jet engines, the new Edison oil pressure indicating system consists of two components—a transmitter and panel indicator. Because the Model 118 transmitter can withstand vibration to 2000 cps, it may be mounted directly on the engine without shock mountings. As a result, it offers greater reliability, accuracy and speed of response.

Ordinary transmitters must be secured off the engine and area connected by lines or tubing to engine pressure source. In such area temperatures of as high as 400°C and high or delayed pressure indication may result.

The new Model 118 transmitter is 50% smaller and 50% lighter (10 lb.) than the Model 118 developed by Edison in 1956. It will accept remote areas of new engine location. JET T 26618.

In simplified design mechanical design makes installation and maintenance easy. Pressure transducer has only one moving part and operates in working in temperatures to 212°C.

For additional information write for publication 5803.

Thomas A. Edison Industries
INSTRUMENT DIVISION

41 LAKEVIEW AVENUE, WEST ORANGE, N. J.

STATION ENGINEERING OFFICES ARE LOCATED IN GREENWICH, GALLUP, BAYTON, SAN ANTONIO

WHO'S WHERE

In the Front Office

Kenneth W. Eadsen, vice president and general manager Nuclear Division, directed a director, Kansas Aircraft Corp., Bloomington, Ill. Also William R. Eadsen, vice president of test and development, James W. Marshall, vice president military systems, C. Lester Moore, assistant vice president—systems.

G. Corbin Hill and John M. Lockhart, directors, Avionics Manufacturing Corp., Middleburg, Ohio. Also Hill is president of the 4th Third Coast Travel Co., all Cleveland, and Mr. Lockhart is vice president of The Kroger Co.

Dr. William Ewart Wilson, international business physicist, elected a director of Bureau Research and Development Laboratories, Inc., Westfield, N. Y.

Frederick H. Vahlgren, a director, St. Louis & Western Airlines, Inc. He is board chairman of P. H. Vahlgren, Inc.

Elmer M. Bink, president and general manager, Del-Tex Aviation, Inc., Dallas, Tex.

Harry L. Housinger, executive vice president, Peter & Bousfield, Inc., subsidiary of American Machine & Foundry Co., Princeton, Ind.

Philip E. Hansen, Jr., vice president of a newly created executive department of Helicopters Division of The Seale Corp., New York, City. Mr. Hansen will continue to supervise the Division's Denver, Colo., facility.

Albert T. Camp, assistant vice president and director of research, Grand Central Rocket Co., Berkeley, Calif.

Walter C. Camp, assistant vice president, General Economic Laboratories, Inc., subsidiary of General Precision Equipment Corp., Passaic, N. Y. He continues as manager of government contracts.

Honors and Elections

John K. Seiff has been appointed vice president for guidance and control in the Office of Program Planning and Evaluation of the National Aeronautics and Space Administration, Washington, D. C. Mr. Seiff is an temporary leave as assistant chief of the Electronics Research and Development Section of the California Institute of Technology's Jet Propulsion Laboratory, Pasadena, Calif. Tom N. Anderson, vice president of Avionics, Inc., has been appointed a non-salariat in the Secretary of Defense, to work with the advisory group on electronic research and development programs for the Army, Navy and Air Force.

Dr. Louis N. Eadsen, of Lockheed Aircraft Corp., has been elected a director of the Electronic Industries Nat. Association, D. C. Also Mr. Eadsen, W. Francis Gaudin, vice president, of the American Military Products Division Executive Committee.

Dr. Robert H. Bode, program engineer for the space research at Lockheed, a director of North American Aviation, has been awarded the Muddy Memorial Medal by the Society of Automotive Engineers for his paper, "The Low Rocker Engine" (Continued on page 158)

INDUSTRY OBSERVER

► Responsibility for systems engineering and technical direction of National Aeronautics and Space Administration's Mercury man-space program have been assigned to Space Technology Laboratories, which also is associated with NASA in the forthcoming Able III 3,000 mi elliptical orbit satellite and the Able TV Venus probes. McDonnell is building the Mercury capsule.

► Detection of subaqueous information at ranges beyond 5,000 mi may be possible as the result of a new type detector under development by Vintec Associates with Navy sponsorship.

► Add Space Gyroscopic Co. to the list of companies bidding for the aerial guidance system production for use on the USAF Atlas Titan Titan. Other competitors include AC Spark, Flg, Kearney, Minneapolis Honeywell and Northrup's Northrop Division.

► Decision on choice of contractor to develop Army's Mauler tactical anti-aircraft missile, originally due last month, has been delayed by up-to-date Army needs over whether the physical funds should be used for acceleration of the Nike Zeus anti-ICBM missile program. Present thinking, however, is that Army will award a contract for the Mauler program, with the final decision due before the end of May.

► New development plan is being advanced for Advanced Research Projects Agency's WS-117L advanced reconnaissance system. Plan envisages acceleration of the program and a matching expansion of facilities. As many as six Atlas boosters may be diverted from the Atlas program and transferred into the WS-117L project that can reduce requirements as well as a result of experience gained from preliminary. Decision on design which originally was included in the WS-117L project.

► Lockheed Aircraft Corp. is considering the design of small submarines capable of carrying a single Polaris-type first ballistic missile and a 10-15 ton war head in connection with the Puget Sound Bridge and Design Co., in which the company recently acquired interest. Lockheed's Muscatine, Conn., division probably will participate in submarine projects because of its background in the nuclear field. Lockheed is considering adoption of plated high-strength aluminum alloys as possible structural materials for the submarine.

► Northrop T-18 jet trainer is scheduled to fly this month from Edwards AFB, Calif., with General Electric YB3 prototype light engine. YB3 is developing a thrust slightly below that specified for operational models of the T-18.

► Long-range plan for Pacific Missile Range includes an anti-aircraft missile range in which anti-aircraft missiles would be fired from a Pacific island, probably Kure Island, against targets launched from the Naval Missile Facility at Ft. Aguilar in the corridor that passes midway and West Island and the Hawaiian Islands. Ballistic missile target location facilities will be at Midway, Wake, Eniwetok and in the Hawaiian Islands.

► Navy's new Lockheed F1V (Electra) will be outfitted with a Doppler-aided electronic anti-air system developed by Latham Industries. Doppler radar, to be provided by Ryan Instruments, will measure acceleration of several times on extended systems.

► Total of \$5.2 million for test facilities for the J-15000 lb. thrust engine-chamber Rocketdyne space booster engine is programmed in National Aeronautics and Space Administration's supplemental budget request for Fiscal 1959.

► Army Ballistic Missile Agency holds about 520 million in contracts from National Aeronautics and Space Administration in the current fiscal year and already is programmed for about the same amount in Fiscal 1960. The 1960 total is expected to increase.

LINDE's NEW PLASMAC TORCH SERVICE Brings Industry Production Parts From Refractory Metals

No other method of fabricating refractory metals can match this... The high melting points of tungsten, molybdenum, and niobium are no longer a problem. For LINDE's new PLASMAC Torch, working in the temperature range between 13,000 and 30,000 degrees K, can cast parts or form shapes of virtually any size or complexity. It's an entirely new way to make such articles as rocket nozzles, vanes, components for electrical and X-ray use, and parts for atomic energy equipment! The quality of these pieces is uniformly high. Fabrications can be held to $\pm .002$ in. or better. The metal

losses none of its purity and superior density is achieved. With the PLASMAC torch, LINDE is equipped to supply your parts made of, or coated with, refractory metals or made of a variety of metals combined with non-metals or reinforced plastics. LINDE will also provide a wide range of materials testing services based on this device. For information on the extension of LINDE's well-known flame-fusing service, write Dept. AW-33, LINDE COMPANY, Division of Union Carbide Corporation, 26 West 42nd Street, New York 17, N.Y. or Canada Linde Company, Division of Union Carbide Canada Limited.



For PLASMAC Torch employs a non-transferable electric arc to generate such high temperatures that particles or wire fed into the chamber is literally melted, hard gases blowing continuously carry the molten particles in a plastic state and deposit them on the workpiece or extrude into specific shapes. After the particles solidify in form heat-treated and annealed material. Castings—made in graphite—have no residual stress. Shapes are built up on nonoxidizing mandrels, which are then etched away to leave parts such as these shown above.

"Linde," "Union Carbide" and "PlasMAC" are trademarks of Union Carbide Corporation.

Washington Roundup

Nuclear Plane Decision

Watch for an early decision by the Administration on proposals that it abandon its golden-rod-type nuclear approach in development of a nuclear program in favor of an accelerated project to get a flying jetliner into the air.

"Showdown" arises in such agreement as the program was intended to be held last weekend, provided by an official spokesman of the ANP project at the Brooklyne, Ohio, plant of General Electric. Scheduled participants in the discussion and the session included those members of the Joint Congressional Committee on Atomic Energy: Sen. Charles McNair (D-N. Mex.), chairman, Rep. Morris Papp (D-Ill.), chairman of the Research and Development Subcommittee; Sen. Rusk (D-Calif.), ranking Republican Senate member; Rep. James Van Zandt (Pa.), ranking Republican House member; Rep. George Hansen (Calif.), second ranking Republican House member.

Official participants were also House Minority Deputy Secretary of Defense Donald Quarles, John A. McCone, chairman of the Atomic Energy Commission John F. Kennedy, an AEC member, H. B. Loper, assistant to the Secretary of Defense for Atomic Energy, and Air Force Maj. Gen. Donald Kern, assistant USAF deputy chief of staff for nuclear review.

Rep. Papp, who has spearheaded the congressional campaign for an expedited "fast" program, originally announced a public hearing for a showdown with Secretary Quarles, who has opposed speeding up the program—unless and until there are technical breakthroughs (AW Feb. 16, p. 32). Apparently, it was decided to attempt to work out agreement on a program.

Support From Vinson

Meanwhile, House Armed Services Committee gave its support to Papp's nuclear plane campaign. Following testimony by USAF Secretary of Defense, the committee chairman Rep. Carl Vinson (D-Ga.) declared that "the 70 members of the committee and the country at large" are "very much concerned." Asked the most significant Soviet aerospace developments in addition to the U.S. nuclear aircraft program, Vinson replied:

"Most interesting to us is the development of an advanced bomber which appears to be a supersonic bomber. What they do with this development is of course, very important. We can't tell here whether this bomber is going into production in an operational form or not. But this has been viewed as a bomber that is a supersonic and it has been suggested by some members of the committee that it is available on the subject that this might represent a step in a nuclear-powered aircraft program. In an evaluation done last Dec. 1 or 2, 1959, the Air Force was reported that the prototype of a nuclear-powered bomber is being lightened in the Soviet Union."

Soviet Effort vs. U. S.

Soviet Russia's total annual military effort is "roughly equivalent to our own," even though the Soviet Union's gross national product is "some ten times that of our own," Central Intelligence Agency Director Allen W. Dulles said last week. Dulles and Rusk in debating Soviet efforts to reach its goals without resort to military force.

in the U. S., giving it the highest proportion in the world.

Although "our military position is stronger and our ability to collect defense is better greater than that of the Soviet Union," Dulles said, the Russians "will find that their own foreign policy can be somewhat more assertive" as they reduce expenditures and nuclear power grows. Russia hopes "eventually to be able to hold the U. S. under the threat of nuclear attack by international ballistic missiles while they consolidate their position in the fragile parts of the non-communist world," Dulles said. In 1956 during the Suez crisis, he said the last Soviet missile sailing, as a new test of Moscow's defense, was launched in 1955. He said the Soviet Union through 1955 was 9,750 to 10,000 for the U. S. in 1955 (over 100,000 in 1957), he said. In 1955 it figured into the U. S. average, the comparison is "even less favorable" for the U. S.

Union Dispute

Airline Stewards and Stewardesses Association is considering severing all ties with its parent union, the Air Line Pilots Association. The union charges that ALPA failed to back last year's strike by Lake Central Airlines' stewardesses and that union siding with Lake Central Airlines has been carried out by another ALPA-backed union, the Airline Stewards Association. At ALPA's recent Chicago convention, delegates passed a resolution empowering its president to formally disaffiliate with ALPA if the pilots union fails to offer more satisfactory extension cooperation.

Used Aircraft Report

Public distribution of the Air Coordinating Committee's report on used aircraft was still being withheld late last week because of inability of the group to reach consensus on ownership and liability issues. Two points remain: ownership and liability issues. A market that is expected to help define surplus supplies within the U. S. and overseas, one technical specification about which surplus operators are unable to agree, and one about which surplus operators are unable to agree. Second problem arises from the question of when liability should not be the result of an accident of an aircraft with U. S. registration based in foreign operation. Changes are strong that the two points will delay distribution of the report for some time to come.

New Look at Small Business

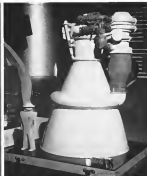
Small Business Administration Director's Bureau is scheduled on April 21 open meeting in Washington to hear suggestions as to whether government small business benefits should be extended to firms with 1,000 or less employees. Present official definition only takes firms with 500 or less workers.

FAA Vowings

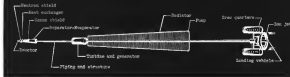
Top post in Federal Aviation Agency's Office of Public Affairs has not yet been filled despite the fact that Public Affairs, who has been leading the office at acting chief, will leave FAA this week to join the Rhode Island-based Lockheed Aircraft in Swampscott, Calif. Meanwhile, serious consideration was being given to the naming of William S. Lough, editor of the Pittsburgh Star-Telegraph, as a consultant to the FAA for public affairs although no official action has been taken as of late last week. —Washington Staff



FIRST DETAILS of Conquest second stage, using two 15,000-lb. Pratt & Whitney liquid hydrogen engines, is shown to Congress last week by National Aeronautics and Space Administration. First stage is Atlas, later third stage will be available.



FIRST INDICATION of slender 15.5 million lb. thrust single thrust hot engine unit was given by model (above) at NASA hearing. Three-stage (below) for nuclear satellite (below) under study by NASA, too single stage, power go through it three times.



NASA VEHICLE studies by National Aeronautics and Space Administration's Lewis Research Center indicate that nuclear technology power would provide great weight saving over chemical propellant for some missions. Systems would produce 12,000 lb. and 75 lb. of thrust, allow for several months' manned exploration. Thrust powerplant would cut up from 1,000 days to 600 days.

Space Technology

NASA Details Space Missions, Needs

Fourteen satellites, six probes programmed by end of 1960; propulsion projects for space outlined.

Wilmington-National Aeronautics and Space Administration last week outlined to Congress the missions for 14 satellites and six space probes that it plans to launch by the end of 1960 and discussed rough timetables and aims for chemical, nuclear and electric propulsion systems now being developed.

Highlights of the testimony—presented to a subcommittee of the Senate Aeronautical and Space Sciences Committee, which is attempting to build a comprehensive record of the current and future national space programs—

• **Long-range plan** to put a scientific observatory on the moon and more immediate plans for extensive surveys of the atmosphere and surfaces of the moon, Mars and Venus by means of orbiting space probes.

• **Plan to put a 5,000-lb. meteorological satellite, a "stationary" communications satellite and a two-axis space ship into orbit**, using a vehicle due to be ready for first flight by late next year.

• **Prediction that no one** topic with "immense efficiency and consumable amounts of thrust" may be as effective within theoretical limits as laser power and optimistic reports on electric propulsion systems in general.

• **Disclosure that NASA has asked Atomic Energy Commission to develop Scout VIII, a nuclear power system that would produce the electrical energy necessary for an electrical propulsion system.** Scout VIII would produce 10 times the power produced by the existing Scout II on which it is based.

• **Plan to orbit an astronomical observatory, possibly as early as one to two years from now.**

• **Plans for the first interplanetary cooperative space venture—a Canadian satellite launched by a U. S. vehicle—to explore interplanetary space.**

NASA witnesses gave these aims, details on a few of the first new vehicles that will be available for space work.

• **Scout.** The low-cost solid propellant

rocket (AWW May 16, p. 36) will send a 1,000-lb. payload to a distance of 12,000 mi. in a 500-lb. payload to 35,000 mi. from earth. It can be used to put satellites in circular polar orbits at 1,000 mi., orbits with 200 mi. perigee and 3,000 mi. apogee at various angles to the equator or orbits with 200 mi. perigee and 15,000 mi. apogee if the orbit is non-circular so that advantage is taken of the speed of the rotation of the earth. Scout also can be used to put up better closed cover satellites, early communications satellites and experimental auxiliary satellites (satellites). It also will be used to test test vehicles of missile new ones.

mineral resources and advanced Dyna-Son concepts, and as a vertical probe. Scout 1960 budget includes 12 million for Scout. Scout's first stage was improved last year late in the Polaris missile program, and the second stage draws on the Minuteman missile program's technology. In the four-stage version, guidance will be carried in the third stage. Fourth stage will be open for orbital missions.

• **Vega.** Fiscal 1960 budget includes \$42.5 million for Vega and widened to the full 10 ft. diam. plus a stage that draws thrust, on the Atlas, using the same nozzles, and powered by a General Electric Vanguard engine with longer nozzle and thrust capability. Engine is due for delivery by late fall. Second stage will be about 15 ft. 4 in. long. Last third stage, powered by a 4,500-lb. thrust engine, being developed by NASA's Jet Propulsion Laboratory, will consist of several stages of tanks and nozzle, and it and the payload will be housed under the sub-deck nose cone. Overall vehicle length will be 30 ft. Vega will use the same launch vehicle, and first stage, as the Atlas, and first stage and the last in

Interplanetary Probes and Payloads*

Type mission	Booster Vehicle	Payload
Initial planetary probe	Thor-Able	90 lb.
" "	Atlas-Able	290 lb.
" "	Vega	1,400 lb.
Venus, Mars and Mars-orbit	Vega	1,300 lb.
Venus, Mars encounter orbit	Vega	340 lb.
" "	Proton V	800 lb.
" "	Vega	1,000 lb.
Venus, Mars atmosphere entry	Vega	1,000 lb.
Solar probe, Jupiter, Saturn, Uranus	Proton V	1,500 lb.
Venus, Mars landing	Proton V	400 lb.

* Based on testimony by NASA witnesses.

Obsolete Equipment, Cutbacks Hobble TAC Reaction Capability

Washington—Obsolete equipment and cutbacks in new aircraft have placed Air Force's Tactical Air Command at a potential disadvantage, TAC Commander Gen. C. P. Wehrland, told the House Defense Appropriations Subcommittee in testimony released last week.

Further complicating TAC's problem, Gen. Wehrland said, is the slow rate of planning in new tactical fighter aircraft, development in funds for research and development of tactical weapons, and the reduction of tactical funds to a minimal attack, especially those located overseas.

Gen. Wehrland told the committee that the bulk of the USAF's reduction from the 1950 aircraft inventory to the planned 1972 level is composed of the YAG. As a result, he said, at the end of the current fiscal year there will be a total of only 31 wings available to tactical air command. He termed five "unbalanced wings" as a result of his order and responsibilities and the personnel superiority of the Soviet forces.

Gen. Wehrland said that, with the present condition of his tactics fleet, he could not always guarantee getting a fighter-phrase force to a trouble spot in the Middle East or Europe.

He termed the present tactics fleet as "second-rate-down to second-rate," citing of 300-700 hours needed to train a pilot, he said, have to be reduced to 15,000 hr. in refuel and then, to keep sufficient stock, must close to about 12,000 hr. the pilot.

"There are a lot of conditions in degrading aircraft from the U. S. to Europe where we cannot lose the weapons, and it is most difficult to replace a single-engine fighter when the poor fighter pilot is his own navigator, radio operator, and everything else. He is in there as a lead dog and to fly to refuel, communicate, navigate and land, and he has to be able to do all of these things. However, we are training them for it, but it is a very significant expense."

In answer to a question as to what percentage of the total inventory of planes assigned to TAC operations need modification and modernization, Gen. Wehrland replied the entire tactics fleet. "I would like to see jets, and I would not want that at the top of my head, but I think it is not a matter of opinion, to ensure the mobility of getting our tactical forces to the right place at the right time," he said.

Gen. Wehrland said he now has six squadrons of tactics with 28 to a

squadron. He added that, if these were replaced with F-105 jet fighters, four tactical squadrons probably would be sufficient.

He and he also was concerned with the role in which new aircraft were being planned. The Lockheed F-104 and Republic F-105 are now coming in but in rather limited numbers, he said. He said there also is a question as to whether USAF has sufficient funds to pay for the number of F-105s currently proposed.

"In the research and development area," he said, "we should very soon be developing the airplane on paper, and so, which will replace the F-800. This should be what we call a virtual or design aircraft and having engine. We have very little money put in so that, not enough to assure that the airplanes will come along at the time I feel they will be needed."

Such an aircraft, Gen. Wehrland explained, would eliminate a lot of the need for large concrete runways where they could operate from almost anywhere. It would also make deployment much easier and, at the same time, lower the country's attack capabilities because he would need far greater numbers of weapons to knock the focus out.

Another concern, Gen. Wehrland said, is the problem of survival from a surprise attack. At the present time he felt the deployed overseas forces could survive enough money to get off on

acceptable number of aircraft to retaliate against the attack.

"However, at such a time for Russia developing their nuclear or other forces as they can reach us with less warning time than we are in our state."

Gen. Wehrland told the subcommittee that "less-length" increases for lighter aircraft have been considered for Europe and that, while it has some advantages, it does not appear to be a good solution as a long-range proposition.

He said he also had proposed land-based "airbases" situated for protection of tactical fighters. He said he had requested the aircraft and that the theme considered was in one place, even though it was the most practical and economical solution. However, he said that to him, knowledge no funds have been set aside for this.

Gen. Hovey I. Hodes U. S. Army commander in Europe, said the subcommittee that his major concern is keeping his present equipment in first class condition and keeping an adequate number of supplies on hand. He also told the committee that:

•He needs 560 million more than this currently programmed to maintain combat readiness.

•Northern Block immediate anti-missile needs are badly needed for the U. S. 7th Army. He is presently programmed for Europe.

•Despite the fact that Russia has decreased its personnel to a limited degree, it has increased its combat capability considerably, presumably through the introduction of new equipment.

•The nature of modern war is so forced to exceed new practice that he probably would have to give up additional practice slots.

Navy Requests for Aircraft, ASW, Missiles Trimmed in 1960 Budget

Washington—Fiscal 1960 budget requests from the separate Navy bureaus were trimmed by a total of almost \$7 billion, to \$14.2 billion, the House said. That was, of course, a great disappointment to us. In this particular budget, I think we in the Navy have been unable to explain satisfactorily the really urgent need for new ships and new aircraft and missiles."

Another critical area cited by Adm. Burke was the "very low" funds available for spending Navy aircraft. Burke, who indicated Navy is now trying to get Budget Bureau to increase to \$13.8 billion within Adm. Burke's office before being sent to Defense Secretary Neil McMillen. When it was returned, the figure stood at \$11.45 billion.

Adm. Burke told the House Subcommittee on Defense Appropriations that the Navy budget "ended up with no percentage after everything was all through, the same as it was last year." He said the Navy's share of the total was cut by 10 percent, and that the Navy's share of the total was cut by 10 percent, and that the Navy's share of the total was cut by 10 percent.

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FLOW LINES through will follow in a proposed environmental test for Project Mercury in orbit in the coming weeks. Certain details shown in orbit.

Mercury Oxygen Contract Awarded

Los Angeles—Environmental control system for National Aeronautics and Space Administration's Project Mercury, space shuttle will have a 28 lb oxygen supply, which will add to the oxygen, breathe, will serve to per- manent, and cost both the capsule and the pilot's suit.

Contract for development of the environmental system has been awarded to the Alhambra Manufacturing Division of the Garrett Corp. by McDonnell Douglas Co., space program contractor. Alhambra also supplies the environmental system for the North American X-15 research vehicle in which carbon dioxide scrubbers are used to remove carbon dioxide from the cabin.

systems will maintain pressure equivalent to 12.1 in. of mercury (pressure at sea level is approximately 29.9 in. of Hg). Oxygen concentration at 12.1 in. will be greater than that at sea level. The Project Mercury environmental system will consist of two circuits and will work as follows: In one circuit, a fan will pull oxygen from the pilot's suit and through a dehumidifier. The fan will then push the air through an oxygen scrubber, carbon dioxide scrubber, and heat exchanger, water alcohol and back into the pilot's suit.

In the other circuit, another fan will pull air from the cabin, and it through another heat exchanger and back into the cabin.

TWA's Gains Tied to Revised Schedules

Improved financial results in second half of 1958 attributed to analysis of schedules and cost studies.

By Gloria Garcia

New York—Advantage of schedules has been the largest factor in Trans World Airlines' sharply improved operating results, TWA President Charles S. Thomas told *American Week* last week.

Even with the ill effects on traffic of a 17-day strike late in the year, the airline showed an operating profit of \$94,000 for the last six months of 1958, compared with an operating loss of \$1,301,000 for the same 1957 period.

Action items under the new profit plan's direction has included an intensive analysis of each segment of each schedule on TWA's routes, followed by a complete schedule revision. Along with the scheduling, there has been a cost study of every facet of the airline's operation, according to recommendations which eventually are expected to save TWA about \$10 million a year.

Major Modifications

Also in process are major modifications of the company's organizational structure, with special emphasis on communication and the chain of command, and a new budgeting system.

Thomas told *American Week* that even one of TWA's flights had been cut unopposed, and then each flight leaders into segments and the cost of each segment compared. Utilization of equipment has then stepped up on the profitable line and reduced on the less profitable ones. Shifts in service also were made in some cases.

Thomas said, the studies showed too heavy concentration of routes served and adjustments in favor of first class service were made.

"In this business, scheduling is, in my opinion, a very No. 1 thing," Thomas told *American Week*. The schedule revision had "by far the greatest effect on TWA's new situation, although other factors helped, including better business in general."

Thomas, after he returned last week to TWA president last July, set up the task force to study even one of TWA's expenditures. He pointed out areas within the company for this work, and broke them down into communication, sales, passenger service, operations, finance and general.

Recommendations from the task force were put into effect and fourable results were particularly apparent in the last quarter of 1958, Thomas said.

Because of the strike, which made

single fuel stop is made at the station where fuel costs are lowest.

- Options aircraft engine power determined by an intensive study. Advancing to first standards is expected to save \$750,000 annually.

- Reorganization of engine controllers' departments, involving among other things a reduction in area controllers expected to save \$175,000.

- Adoption of Federal Aviation Agency-approved airport facilitation plan for pilot qualification to reduce flight training. Expected saving \$120,000.

- Consolidation of the reservation control function, formerly split between New York and Kansas City, at New York. Expected saving \$90,000.

- Elimination of the passenger ticket message system at Idlewild. Expected saving \$50,000.

Flexible Budget

The new budget system, Thomas said, will save a major expense control tool. The old quarterly budget system, he said, "did not been given to present operations." Under the new plan, the budget will be annual and flexible. It will be set up at the start of the year. At the same time, operations standards in all areas will be established.

If revenue exceeds efficiency and performance to standards warrants it, the budget can be amended to provide for more personnel. On the other hand, such can be made when the opposite conditions appear.

Generally, the tight expense control plan is comparable to that of other airlines of reducing and cutting out "volume costs and losses you don't need," Thomas said, but this will not include "fixed cost reduction in people," he added.

Airline Improvements

The new chief executive hopes to effect major improvements in communication between the field and top management and particularly to delegate more day-to-day authority. There are now 15 different persons reporting directly to the president, making that office "the day-after operator of the company," according to Thomas. This leaves the president with insufficient time for the accuracy planning and long-range thinking which his duties require.

TWA's basic route system is excellent, Thomas said, and should give it with proper scheduling, efficiency and expense control. Utilization will be one area of a problem as his first



EXPANSION of Trans World Airlines' jet service will follow delivery of additional Boeing 707-120s. First airplane destined for TWA as shown above at Boeing's Renton, Wash., plant, being loaded for first flight. Other jets on the ramp are 120s for American Airlines and Delta, the Australian airline. TWA jet service between Chicago and Los Angeles was scheduled to start last week, and New York-Los Angeles service is planned by July. Airline inaugurated its first jet service Mar. 13 with New York-Kansas City.

in planes appear as phased out and jet pilots retire.

By the time the Conquest 800s arrive in 1960, TWA's piston equipment should be fairly well phased out, Thomas said.

TWA inaugurated its first jet service on Mar. 13, a daily transcontinental service between New York and San Francisco.

Chicago-Los Angeles jet service began the week the other was scheduled to begin last week.

New York-Los Angeles service will follow later this month, Thomas said, and additional cities will serve. TWA jet service by July. During that month, Thomas said, the airline will be operating six daily jet schedules with 660 seats out of San Francisco to major U.S. cities.

Operating Loss

While TWA's losses showed a marked upward trend the last half of 1958, its net operating loss for the year was \$1,764,430, some \$185,000 greater than the net 1957 loss. This was attributed chiefly to lower gains on the sale of equipment, lower fuel costs and higher maintenance costs. Operating loss for the full year 1958 was \$175,000, compared with operating losses of \$4,510,000 for 1957 and \$1,111,000 for 1956.

Filed last week was strike in 1958, Thomas believed, the company would have shown an overall net profit for

the year. As yet, TWA showed the highest second half-of-the-year operating profit since 1954.

Decreasing the results seen by task force, Thomas told *American Week* "I'm not going to let myself off, but I think we're on the right track now." There is "nothing wrong with the people in TWA," he said, and the main course often an excellent person.

"Given the proper organization and leadership, there is nothing in the world to prevent TWA from being one of the most profitable airlines in the business," Thomas said.

American Protests Supplemental Ruling

Washington—American Airlines has taken legal action to reverse a Civil Aeronautics Board ruling granting passenger operating authority to 25 persons not certificated as carriers.

Attorneys for the airline, protesting the Board's action as the Large Infringe Air Carrier Investigation, Long filed for a review of the decision in the U.S. Court of Appeals for the District of Columbia.

Granting of the certificate will allow the supplemental carriers to compete directly with American. As few as three of the newly certificated carriers could provide a daily schedule between any or all of American's points

by utilizing their 10 top month authorities between any two points in the United States, according to American.

American added that Board approval of uncertificated charter service in air freight operations also could lead to the establishment of an unlimited number of competitive freight-carrying airlines displacing the existing freight services of American.

In a 17-point objection to the CAB order, American termed the Board's action "arbitrary and capricious" and said that it:

- Failed to specify the terminal and intermediate points for the supplemental service in violation of Section 406(a) of the Federal Aviation Act;
- Established a definite legal barrier for the supplemental service in violation of Section 406(a);
- Exceeded the proper scope of the Large Infringe Case in granting individuals not certified as carriers additional operating authority in air freight operations without requiring certified services;
- Took no action to smooth the transfer of control between supplemental carriers through their participation in board upon the qualifications of existing management;
- Failed to provide for revocation of existing operating authority, contrary to the public interest, and thus encouraging trafficking in supplemental air carrier certificates.

TWA Jet Deliveries

New York—Trans World Airlines' previously announced jet delivery schedule, as outlined in *American Week* by TWA President Charles S. Thomas, will be met in all of the airline's 15 Boeing 707-120s by July.

Delivery of the long-range Boeing 707-120s will begin in November, Thomas said. Hughes Tool Co. has ordered 30 of these aircraft. First jet equipment under current plan, the Conquest 800, will start arriving in early 1960, according to Thomas. Hughes has ordered 30 of the 800s.

Qantas Loses U.S. Domestic Route Bid

Washington—Qantas Empire Airways last week lost its bid to compete in U. S. domestic air travel contracts on the transcontinental segment of its around-the-world route.

In a controversial decision on a petition filed by the Australian carrier to transport international traffic between two U. S. ports the Civil Aeronautics Board found that foreign airlines may carry only that traffic within the U. S. which it offers longer routes or will take out of the U. S. The decision was issued in an opaque and unorthodox ruling following the submission of a misleading proceeding.

The ruling is expected to threaten any future route for foreign flag carriers to such uniformly to operate within U. S. domestic markets and establish the right of embargo by U. S. operators. Challenge is the principle that each

carrier can reserve the transportation of all types of traffic within its own territory for its own network. There are 15 foreign airlines authorized to serve two or more points in the U. S. Currently, Qantas sought from the Board an interpretation ruling that would permit it to carry international traffic between San Francisco and New York regardless of how that traffic entered or departed the U. S. (AW May 18, p. 18).

The Qantas bid had the backing of British Overseas Airways Corp. which is seeking a Board decision on a request to include Tokyo on the trans-Pacific leg of its around-the-world route. The airline "temporarily postponed" its trans-Pacific service last week, charging Northwest Airlines with a delivery agent that forced it to stop the service two days after it was suspended April

1 (AW April 6, p. 46). Here is a summary of findings in the CAB on the Qantas case which began only last year.

• **Restriction in the Federal Aviation Act** that no foreign mail aircraft shall be on at any point in the U. S., Japan, (except as mail carrier for compensation and hire) and defined by another point in the U. S., applies to foreign air mail aircraft operating under a foreign air carrier permit issued by the Board.

• **Restriction applies** to all traffic including traffic that will continue to move to a foreign point by another air carrier or other means of transportation.

• **Ten "longer air transportation"** as it appears in foreign air carrier permits does not preclude a foreign air carrier to some traffic between two U. S. points.

Decision against Qantas by the Board is expected to discourage a notion that has been developing for the past six months between the U. S. and the British Commonwealth as an transportation matter. These differences have been sharply intensified by the recent opposition Northwest has taken against the BOAC bid to start trans-Pacific service between Hong Kong and New York via San Francisco and Tokyo.

Air Service Agreement

BOAC Managing Director Basil Sealbridge and last week in Tokyo that his carrier has the right to operate the Tokyo service under the Air Service Agreement between the U. S. and U. K. He said the company was forced to delay the service because of the need of a CAB license, an carrier permit and a bid.

"Under British procedure and under the same agreement an American operator obtains an operating permit virtually automatically from the U. S. government," he added that the application for the Tokyo route had reached the CAB on Nov. 4 and added:

"Today, some five months later, we still have not received any permit to make the application in the agreement that permission to operate shall be granted without undue delay. It is impossible, for ourselves it seems this can be done."

In its arguments against the BOAC petition for the Tokyo stop Northwest has contended that BOAC would have an "extraordinary competitive position" in the U. S. Japan market in that that the three U. S. ports—New York, San Francisco and Honolulu—ought by BOAC recorded for \$100,000 of U. S. Tokyo traffic routed by Northwest and Pan American in the year 1957.

In its decision in the Qantas case, the Board made reference to traffic decision by stating that the volume of transfer traffic attached in the Qantas decision is "substantial and represents an important part of what is generally accepted as the domestic market. This is the basis of 1957 survey data, the over all value to all U. S. carriers of transfer traffic" of the type here is valued was in excess of \$10,000,000."

On the subject of competition, Sealbridge noted that Northwest would not compete with BOAC through Honolulu and San Francisco since Northwest does not serve this route and added:

"Nevertheless Northwest recognizes of potential competition from BOAC's new service" and its failure to win rights for a new route beyond Tokyo to Hong Kong.

BOAC Aims

He added that "it should be made clear that what we in BOAC are trying to do is merely to exercise our right under the agreement to provide British competition to the American carriers across the mid-Pacific. There have been attempts by Pan American Airways since 1946, including Hong Kong, with San Francisco. On this route Pan Am can already at this operating service over the route between Hong Kong and Tokyo and actually carries more traffic than any other operator between these two points, not British and the other Japanese."

He concluded by stating that it would be "quite anomalous" to grant another American carrier, Northwest Airlines, a new route into Hong Kong.

Carriers Ask Probe Of National Fare Plan

Washington—National Airlines' proposed 35% reduction in night coach fares to Miami is drawing heavy fire from competing carriers fearful for their own profits in a protective measure.

Northeast, Northwest, Eastern and Delta countered the proposal by filing competing traffic but last week told the Board that will withdraw their own filings if the CAB approves their request for expansion and investigation of the National fare plan.

The objecting airlines contend that the unknown competition that would follow National's reduced fare plan for Miami, Tampa and Washington might would adversely affect the national passenger rate yield in the port where their efforts to attract a "transit" would be continuously as precluded.

Eastern contends that National will be unable to cover the cost of the reduced fare based upon an expected



Convair 880 Pads Designed for Accessibility

Maximum accessibility has been designed into the Convair 880 jet transport pads for boarding and exiting of General Electric (GE) turbojet engines. Engines shown here are equipped with General Electric dual engine type engine support. Pad features only three main engine support—reducing weight at forward end of engine, and two main engine support—reducing weight at rear end of engine. The engine support can, Upper portion of pad is designed with intention to serve as a shock absorber as well as pad loading and suspension base to withstand high temperature control for thermal loading.

yield of 32 cents per average passenger mile as compared to National's present yield of 425 cents per night coach service. Utilizing this yield as a standard, Eastern estimates that National's level even had decline would have to approximate 138% on the Con-140 and 96% on the DC-6 and DC-7.

Eastern said that recent night coach fares between New York and Miami is \$46.80 as compared with \$44.50 by rail and \$37.15 by bus but that even National's proposed \$19.00 fare will have little effect upon passengers who drive their own to Florida. It added that CAB approval of the reduction would be little more than a "gesture" which would cause all airlines to suffer financial losses.

Northeast, which filed for a 25% reduction in night coach fares between Chicago and Miami as a protective measure only, told the Board that such a plan will cost about one passenger but will direct evening traffic into the fare will represent about half the cost of carrying first class fares. Northeast pointed out that since competition on line competition will be stifled in the required service in the General Passenger Fare Case.

Northeast said its reduced fares will of Boston New York and Washington and told the CAB the reduction will not adversely in Florida board traffic enough to offset its expected diversion from its first class service in Miami.

Tokyo International Readies Expansion

Tokyo-Tokyo International Airport Authority has notified Japanese long negotiations with 16 local Japanese associations for settlement of airport expansion project of airport facilities. The authority will pay for between \$15 million for the design of airport terminal from Tokyo City.

The settlement permits airport authorities to proceed with a plan for a recommendation at the field. The authority will spend the first year \$15.5 million (about half the cost).

The airport will take in 1,154,000 sq. ft. of land by filling in Tokyo Bay increasing the total area 38% to 11,680,000 sq. ft. The present 5,415 ft. long and 148.5 ft. wide Runway A will be extended 297 ft. to the north and 195 ft. to the south by September to permit temporary jet service.

Runway A will be used, with the installation of an instrument landing system, for jet passenger planes until the fall of 1963. By that time, the field will be large enough to extend the runway to 11,680 ft.

In parallel with the old runway, a new 10,391 ft. runway will be built. When the project is completed, a port authority spokesman said, planes can take off in only 100 ft. in three minutes instead of the present schedule of over an hour or eight minutes.



Capital Viscount Successful Belly Landing

Capital Viscount turboprop transport in landing gear jammed in the air position, made a successful belly landing at Detroit's William B. Waiter Airport. Aircraft ended the field in about three hours before making its approach in the transcontinental sector. The Viscount made a successful belly landing (bottom) and 11 persons aboard all escaped unharmed. Aircraft was on the New York Detroit run. For details of Viscount accident to Grant Britain, see p. 249.





"Airline pilots prefer concrete runways because only concrete provides the added safety factors"



Capt. R. A. Stone, in uniform, is a pilot.

"On take-offs, a level concrete pavement eliminates the disturbed surface over the runway frequently caused by a wavy, flexible pavement patching the airplane down and then up. Also, there's no dragging action on the wheels such as flexible pavement has when it softens. On concrete you accelerate to take flying speed fast and without a lot of bumps and jolts. Furthermore, concrete means cooler temperatures on the runway which in turn mean greater lifting power from the wings and greater horsepower from the engines."

"For landing as light as it is, we still have to use the runway, even with all our modern electronic aids. Concrete runways are available under these conditions because it reflects light instead of absorbing it, the concrete runway stands out instead of blending in with the dark background."

"Better braking is important, especially in wet weather when you're trying to stop 50 tons of airplane that touches down at 120 miles an hour. (The new jets are even heavier and faster.) They can always take a good, firm grip

on this resistant concrete."

"While everybody wants this kind of safety, some people think concrete is too expensive. However, all the figures we've seen show concrete actually saves real money for airports. The airline pilots recommend spending what it takes to get safety now and simultaneously gain the peaceful, money-saving advantages of concrete throughout the years ahead."



PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

FAA Adopts Mobile Lounge Plan

By Robert H. Cook

Washington—Federal Aviation Agency last week adopted a new concept of passenger handling between terminal and aircraft that could lead to major design changes for all planned jet airports.

Coming out of "finger" facilities now being used at major airports, terminals, and planned for jet airports could virtually be eliminated in favor of a fleet of specially designed "mobile lounge" aircraft for use at the Washington International Airport, now under construction at Chantilly, Va.

Reforming construction progress on the new \$450-million jet airport, James T. Fyfe, deputy administrator of the FAA, said that installation of the mobile lounge system may result in a saving of \$10 million now being considered for other jet airports since its expected advantages are proven at Washington International.

The airport is scheduled to begin operation by early 1961.

Fyfe said all existing architectural designs for jet terminals were considered in light of expected traffic growth at the airport to reach 8.7 million passengers in 1975 and the ultimate need for aircraft space space capable of holding 10 large aircraft at one time.

Selection of the mobile lounge design, with a 20-foot floor saving 30 feet by 1965 is expected to provide the following advantages:

- Permit a construction saving of \$1 million in the terminal building as opposed to "finger" type of building design.
- Eliminate any long walking distances between control terminal building and loading gates which could otherwise reach nearly a mile in the case of large jet terminals.

- Allow a wide degree of maintenance and operations facilities and parking spaces.

- Permit increased maneuverability of landing jets which save two ducts from being required to supply required parking spaces.

- Eliminate the need for any towing equipment or other devices to protect passengers and terminal building from jet noise and blast effect.

- Allow future terminal expansion with a minimum of design change and cost.

As mentioned by FAA architects and planners, the mobile lounge would, in effect, constitute a powerful saving being designed to connect directly to the terminal building or the aircraft. FAA has talked with more than 25 manufacturers, one of which has been selected as the new fabricator to build the first experimental prototype at an expected cost of \$180,000. It already

adopted, manufacturers estimate the lounge will cost about \$50,000.

A refined version of the European bus-to-plane type ground service, the vehicle would stand on cushioned wheels and wheels. Measuring about 13-1/2 ft by 10 ft, it would accommodate about 50 passengers at a second level and could be driven from either end, eliminating the need to turn around.

Planners at Washington International said the short distance from the ticket counters to one of a series of 16 low departure gates which connect directly with a mobile lounge.

Mounted below flight level, lounge doors to the aircraft will close and the convenience will assist in the aircraft where the forward end of the vehicle equipped with pneumatic seats will press against the aircraft fuselage to form a sealed unit. The lounge operator then adjust the seat for no difference in doorways height and around the passengers.

For incoming aircraft, the lounge would be dispatched just prior to its approach touchdown and would be waiting within 200 ft of the assigned parking space, FAA planners said. For remotely large jet aircraft, mobile units probably will be dispatched in pairs. Units would be air conditioned and carry two-way radio communication for direct contact with tower controllers.

Utilizing the lounge concept, FAA officials plan a completely terminal building about 1,000 ft long with 30 gate positions, which later will be expanded to 100 positions. Although planned primarily as a jet terminal, the building will provide a few short finger facilities to serve smaller aircraft, as the Douglas DC-5, Martin 202 and Convair 440 series.

Initially, the service estimates a capital expenditure of \$3,775,000 for the mobile lounge design, compared to \$6,685,000 needed for a finger-type type of building. As to the construction cost, FAA officials point out that it costs about \$75,000 for each 1,250 sq ft gate space while the finger design as compared to each \$70,000 for each mobile lounge space of 500 sq ft, thus affording better utilization of valuable terminal space at a much lower capital cost.

Total annual cost of operating the lounge units, including maintenance and based on projected 1965 figures for the use, jet terminal, will approximate \$350,000 compared to \$1,000,000 for the finger system, said FAA.

FAA spokesmen said that, while the mobile units have been selected as the solution for Washington International, the concept is expected to be of equal value for other terminals now being

designed for jet traffic or major airports, such as Midway in Chicago, where more for further finger expansion is anticipated. In addition, architects point out that it could well answer the needs of terminals where any extra gate use or two jet flights daily by avoiding the need for expensive structural changes to existing buildings.

FAA said it will send one contract for both the design and construction of a mobile lounge prototype for completion by January 1, 1960, after which the vehicle will be tested for a three month period and then manufactured in quantity.

Construction on the new jet airport began last September with clearing operations. Three major contracts, totaling \$16 million, have been awarded as of the \$62 million estimate for the project to date. Buildings are expected to start rising by the middle of this year with openings scheduled for completion by July, 1960, and the first operational flights by Jan. 1, 1961.

House Unit Challenges FAA Report Policy

Washington—House Government Information Subcommittee is challenging Federal Aviation Agency's policy of keeping airport reports on the nationwide tracking of equipment.

Issue was touched off by the costs of a Lockheed Martin at LeGrand Airport on Feb. 5. FAA's refusal to make public release of information on possible difficulties encountered with the new type aircraft resulted in Lockheed Martin Boeing 707 series attracted the subcommittee's attention.

In a letter to Rep. John M. (Doc) Goodell, subcommittee chairman, FAA Administrator Elwood Quesada disclosed that only two aircraft and four persons were voluntarily reported prior to Feb. 1. As a result of a survey by FAA, 20 reports of aircraft malfunctions were subsequently received. Quesada said, "Quesada noted that the Lockheed Martin helicopter and Boeing 707 helicopter accidents have been attributed to various variables in the flight."

"To our knowledge, there has never been a malfunction of more than one aircraft on any one flight," he said.

Quesada and FAA consider reports on malfunctions as a new type of aircraft "to be complete properly submitted to the FAA on a voluntary and, to some extent, confidential basis. Further, that it is good sense to believe that, should we make these reports generally available to the public, we might tend to reduce the high degree of valuable industry cooperation we now experience in receiving complete information on malfunctioning which is vital to continued safe operations."

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important advantages: demonstrably lower cost of operation and maintenance, ability to get in and out of almost any airport, and basic reliability established during the 6,000,000 hours of flying experience of the Convair series in military, airline, and business use.

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Third Conquest 880 Jet Transport Makes Initial Flight

Third Conquest 880 jet transport (Airbus A-300-2) is being used for nine months before and proposed under its initial flight from Lindbergh Field, San Diego, Calif. First Conquest 880 is at Edwards AFB, Calif. for flight test work and USAF demonstration flights.

purchase of 10 Conquest 880 transports to be delivered between October, 1983, and March, 1984. Original order called for six 880s.

The report added that General Dynamics had agreed to "assist" the company in arranging the financing to cover the equipment cost, which is estimated at \$45 million. Meanwhile the airline is seeking a memorandum on its notes covering the purchase of 50 Vickers Viscount turboprops (VW Air 18, p. 41).

In this connection, under personal assurances relating to the memorandum, Capital will be restricted to the purchase of new aircraft or the lease of aircraft without approval of the shareholders—Vickers-Aeritalia.

TWA Flea

Then a few TWA reports its latest equipment program.

Highways TWA Co. has placed orders, under contracts available to TWA, for 15 DC-741 aircraft, 18 Boeing 707-311 aircraft and 30 Conquest 880 aircraft for delivery beginning in 1978. These contracts are subject to modification as to number and model of aircraft received and to specifications of the aircraft including starting options. Hughes is not committed to sell use of this aircraft to TWA, nor a TWA committed to buy use of them from Hughes.

American sources said that capital requirements for 110 new aircraft amount to \$355 million. Apparently, \$70 million has been paid on the aircraft. A total of \$85 million is to be taken down in a long-term debt of \$135 million. The balance of \$200 million, according to the American report, will be paid for out of cash

on hand, only less from depreciation, retained earnings, equipment sale and other sources.

Newsweek reported that its financing program involving DC-741s and 707s is at a cost of \$67.5 million has been accepted. Twelve of the aircraft 14 turbo-prop planes with two turbofans—Douglas and Lockheed—will provide Northwest with approximately 5107 million.

Cash Payments

Eastern will make cash payments in 1979 totaling \$70 million covering the balance of its 31 plane Lockheed Electra fleet to be delivered this year and the first of its DC-741s ordered in 1978. Eastern made cash payments of \$60 million for 17 Douglas DC-741s, and Electra and deposits on its DC-741s.

Of the new reporting carriers, then, the balance of which was grounded during the year because of strikes, started a decline in revenues and operating expenses. Two airlines, Continental and TWA, reported net losses for the year.

Both Continental and Northwest reported a 27% increase in operating revenues, highest increase recorded by the group. Northwest reported a 72% increase in net income. Capital costed a 1977 net loss of \$17.7 million into a \$211.0 million profit last year.

American's \$16 million net profit was the largest reported by the nine carriers. Net profits reported by Western and Eastern were less than in 1977—all seven reporting profits showed an increase in earnings. TWA's loss in 1978 was larger than its loss in 1977 but the carrier reported an operating profit of \$18 million during the last six

months of 1978, highest profit for the last half year since 1956 operations.

Continental's loss of \$132,000 in comparison with a 1977 net profit of \$96,000 was attributed to transportation costs resulting from the strike from a regional-type carrier with short-haul routes to transcontinental-type of operations in long-haul high-density markets.

Losses dropped and the general loss was accentuated by the fact that the carrier's operations are facilities in preventing the full development of revenue potential during the year.

ATA Asks Withdrawal OF CAB Probe Order

Washington—An Transport Association has asked the Civil Aeronautics Board to withdraw or modify its May 14 transportation order in view of ATA's voluntary agreement to cooperate in the proceedings (AW May 14 p. 40).

The latest ATA move, however, has no bearing on the filing of CAB's subpoena (AW April 8 p. 48).

Questioning the legality of what it terms "no more than a killing expedition" and a "moving operational investigation," ATA said that, since the month sought by the Board are being ordered, "nothing is in the way of legal process." CAB's formal order would require cooperation.

Meanwhile, a growing number of ATA carrier members have taken issue with the Board and under through regional carrier persons. Allegations, including American National, United, Braniff and Delta have demanded that CAB with direct persons of its order calling for carrier members to face ATA to produce its records on grounds that the Board is exceeding its legal authority and is attempting to accomplish its ends by the CAB can not do this.

This contention that, while CAB has authority to demand certain records and reports from air carriers, it is questionable whether the Board has much power over its consequential concern with ATA.

Other points are that, under the Federal Rules of Civil Procedure, such a negotiation was not or to be used in its own capacity, in cooperation with federal statutes and is, therefore, recognized as an independent entity which documents and papers are its own property and not those of its members.

Challenging the Board's legal authority to demand its records, ATA said CAB's doubt of its own power to do so became apparent when it recently asked congressional enactment of Section 401 of the Federal Aviation Act to extend the requirement that the Board to investigation of an aircraft

Boeing Lists Pan American 707 Damage

By Russell Howles

Seattle, Wash.—Damage to a Pan American Boeing 707 jet transport occurred during an abrupt descent over the Atlantic Ocean Feb. 3, ranged from scuffs on the stabilizer fin to a "light permanent set" in the wings, Boeing Aerospace Co. officials said during a Civil Aeronautics Board hearing here.

Hearings followed taking of deposition at New York (AW May 21, p. 37) and were scheduled to continue last week in Los Angeles with Lockheed Aircraft personnel.

The aircraft apparently struck Mach 95 and later landed safely at Gatwick, Northbound.

In its official statement to the four-man CAB team, headed by Vice R. D. Brien, Boeing said that the 707, a 40-year-old aircraft, was in the midst of a steep climb and was not in a position to descend when it struck the water.

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- Partial failure of No. 5 engine attack bolts.
- Damage to right-hand wing body fitting.
- Wrinkles in stabilizer skin.
- Slight buckling in 2 elastic skin and several flows burst just ahead of the fuselage with air wing over which Boeing began to pick up wing loads.
- Failure in compression of internal fuselage control rails which are designed to cope with compressive loads of high speed, almost up-burst.

High Load Factor

Boeing concluded that damage had not been caused by trial of the carrier of present outside limits but by the high load factor with GP in the carrier stage. He attributed the load factor at five for an altitude of 30,000 ft and speed of 450 kts. Damage to the tail was probably caused by heavy down loads which were used during acceleration during the corrective maneuver.

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Second Dart Herald Aimed at Asian, Indian Markets

Second Herald Page Dart Herald subsidiary looks like to be expanding its marketing several destinations from to India and Asia. The first Dart Herald prototype tested and based Aug. 30, 1978, while on route to the Farthermost air show (AW Oct. 30, p. 42).

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Sud Caravelle Jet Transports Nears Completion

Five Sud Aviation Caravelle jet transports near completion at Sud's Toulouse production plant in France. Photo shows three Sud Aviation Caravelles, plus the second production 340. First aircraft is long-delayed. Both 340 and Air France will begin Caravelle service on May 15. First will deliver 37 Caravelles this year and expects to reach monthly production rate of five by 1968.

around the Mach number into the, possibly require a back position of 15 ft. on the control column would be needed to maintain altitude and prevent stall around post Mach 9. Looking this over, the airplane would come on or not according to Mach 95 at which point stability would vary.

Setting and the 100 is likely stable all the way to Mach .95 but above about Mach 95 less, even much of the wing has separated and very little that would be needed to make flow over one wing separate rather to the airplane would roll toward the wing where separation is most complete. He said that with the aircraft trimmed for Mach 92 and Mach two toward off, the aircraft would tend to go into a spiral or Dutch roll, pick up speed in a gliding motion and reach Mach 95 in about one minute.

A swept wing transport was said less likely to stall than a straight wing design because it favors a Dutch roll mode which reverses itself. Another, rather obvious, on the basis of a dump-up, saying, that the F4U 781 had rolled right to somewhat beyond Mach 35. Moments later right, during the dive was attempted at between 10 and 15 deg.

Being test run here after return of the aircraft found the Mach trim to

function very close to design, several other engineers and Mach warning bell was known to cost a hour rather than the intended ring because of a loose center bolt. The bell also indicates high Q (dynamic pressure) at 350 kt indicated air speed.

Autopilot disconnected warning light stopped functioning part way through the Seattle test and the trouble was isolated as a rick. Boeing engineers feared that the pitch trim potentiometer would not return to center when the autopilot was disconnected but disconnected that in having no, during the accident. They reported that small error would make the difference and large errors would make the autopilot unstable, especially before the accident.

Being engineers bothered in regard to the effectiveness and safety of the autopilot computer used with Boeing 76-30 autopilot to disconnect auto controls if a discrepancy occurs between commanded control position and the actual one. This, and that the computer themselves are not checked in accordance at the moment of autopilot failure, which could be critical in a coupled approach and possibly use of a radar range of control forces. They reported, however, that loss of the computer would not result in a loss of safety. Autopilot cannot be engaged

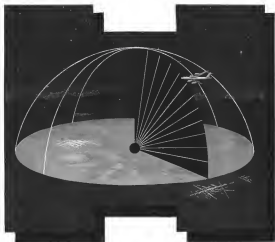
with computer turned on if suggests that because of a failure, but it can be engaged after a computer failure if the computer is turned off.

Being engineer Paul Schaeffer said he has seen no evidence to indicate that the passenger oxygen system failed to operate as it was intended to when pilot actuated the switch to start passenger masks over their seats and both failed actually popped out. He said that mask system is powered by the differential between oxygen mask and pressure and release pressure. Since there was no indication of a loss of cabin pressure during the accident it would not seem unusual for some of the masks to stay retracted. They are not intended to supply therapeutic oxygen.

Being engineers concerned with getting about the reliability of data gathered by a flight recorder which was installed in the left side of the engine. They said that flight test experience has shown the recorder to be accurate in a frequency range of about 10 Hz up. This and significant data would be most likely affected by the test also called speed takes in the second "unlike, or impossible."

Regarding is being analyzed by Lockheed Air Service at Burbank, Calif. and results will be reported in further developments.

THE UMBRELLA



THAT NEVER LEAKS

To achieve umbrella-like radar protection Hughes engineers at Fullerton, California, have developed systems which position radar beams in space by electronic rather than mechanical means. These unique three-dimensional radar systems are digitally programmed to continuously direct high-speed energy beams, even at low altitudes.

Other defense systems under development at Hughes in Fullerton are Data Processors which increase the effectiveness of hundreds of aircraft, store the information and engage defense weapons, radars with beams capable of detecting and tracking man-made and even radar systems for navigation on surface and subsurface naval vessels.

Other Hughes activities are delving into similarly advanced areas of electronics. Engineers at Hughes Research & Development Laboratories are probing into the effects of nuclear radiation on electronic equipment, studying advanced microwave theory and applications, and examining communications on a spatial scale. Applying this advanced type of creative engineering to commercial projects is the task of engineers in the Hughes Products activity.

The highly advanced and diversified nature of Hughes projects offers creative engineers and physicists the opportunity to build a rewarding career in a progressive and expanding environment.



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Many industrial programs at Hughes have proved successful openings for engineers in positions in the following areas:

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Micro-wave Engineering	Industrial Systems
Industrial Electronics	Control Design
Communications	Component Engineering
Digital Computers	Electronic Tubes

Write to Hughes at Mr. Tom Brown,
Hughes General Office, RM. 4-44, Culver City, California.

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INTEGRAL reduced driving of USAF personnel on the Jupiter intermediate range missile is followed by integrated weapon system training at this site at Henslow Ordnance Depot, Henslow, Va. Support vehicles are spread across the yards in approximately the pattern in which they would be deployed, but at shorter distances. Note H-frame and A-frame cranes track positioned by second missile in background. "Orange pod" shells at base of missile protect personnel, equipment, design information and checkout.

Speed Marks Jupiter Development

By Evert Clark

Henslow, Va.—Jupiter intermediate range, ballistic missile weapon system was brought into existence in less than six years.

Although the missile itself was ordered into development in the fall of 1955, work on the present ground support equipment did not begin until Jan. 2, 1959. Troop training did not begin until mid-February of last year.

This greatly telescoped schedule for

proving the weapon, developing and producing its ground support equipment and training the crew to use it was due to an impressive amount of hard work and extremely close cooperation between the Jupiter developer—the Army—its user, the Air Force, and the Jupiter contractor.

Jupiter did not always enjoy such a happy life. When its development was ordered by the President late in 1955, no previous war made for ground support equipment production at the other pertinent and successful ex-

amples of a complete weapon system. In November of 1956, the roles and weapons war was brought to a head by Defense Secretary Charles E. Wilson's order limiting the Army to development of missiles with ranges no greater than 200 mi.

This forced Army Ballistic Missile Agency to be limited to development of proving ground equipment and some planning for supporting equipment but ABMA had earlier actively set hands to develop field equipment.

Another case of uncertainty followed

while Defense Department evaluated Jupiter concepts and just long enough for the Jupiter and its Air Force contractor, the 804th Strategic Missile Squadron, the Thor, with its air base and almost no one of them.

Finally, in the fall of 1957, the decision was made that both weapons would be produced and that USAF would deploy both in Europe by the end of calendar 1959. This had about an 18-month head start in a weapon system.

Development of supporting equipment for Jupiter was ordered immediately, but the decision was not clear cut and the work was not begun in earnest direction.

In mid-October of 1957, Army Lt. Col. Thorton Paul, now deputy commander of Army Ballistic Missile Agency, to explore the ground sup-

port equipment job. Shortly thereafter, USAF named Col. William C. Eick to lead the first Jupiter unit—the 804th Strategic Missile Squadron (1959).

Army first received the Thor equipment to see if it was compatible with the Jupiter. The hope was that one piece—most and Jupiter crew could serve both missiles.

But the differences were many. The missiles have different weights, diameters, guidance and control systems, were made by different companies and other considerations.

Thor is stored in a horizontal position and kept under a horizontal shelter that slides back on rails. Its structure is braced to a concrete block that also serves as a launching pad.

Jupiter is kept in a vertical position and is braced that way. It sits on a

simple launching table that also must be used to position it in the proper azimuth. After such a discommoded launch on its tank, Jupiter had planned to use those tables. The Thor instead used pneumatic to feed projectiles, while Jupiter used pumps.

At the end of October, 1957, Army Ballistic Missile Agency began trying to modify the design of the Thor equipment to fit Jupiter. In mid-December, Army had decided this couldn't be done, at the time schedule was to be met due to lack of USAF contractor production capacity, and both parties agreed that Army designed equipment quite similar to the Redstone system would have to be used.

On Jan. 2, 1959, Army Ballistic Missile Agency finally got a firm directive to develop design efforts and began developing an integrated support

MISSILE ENGINEERING



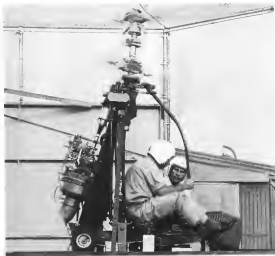
BATTLESHIP arrival of Jupiter missile is used by training of USAF troops at Henslow, Va. Combination H-frame and A-frame hold it used to position missile on single missile launcher.



TECHNICIAN supervises emplacement of Jupiter-1B2A at the training site used by personnel of the 804th Strategic Missile Squadron, first to be trained in the Army-developed missile.



SHAPERS shape Jupiter missile (left) after center of gravity passes the point where the missile is brought to the launcher. H-frame and A-frame can be disintegrated in various ways but was not used. Right: Jupiter is emplaced on missile launcher.



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a wide variety of fuels—including gasoline, kerosene, diesel fuel, jet fuels and natural or manufactured gas. Investigate the Solar family of gas turbines for your power needs. Write to Dept. E-351, Solar Aircraft Company, San Diego 12, California.



ENGINEERS WANTED: Challenging projects, untold opportunities with Solar. Write today!

Missile Subcontracts

Army Ordnance Missile Command from the breakdown on Rocket and Jetter subcontracting by Chrysler Corp., the prime, from the period Oct. 1, 1958, through Sept. 1, 1959.

Total dollars spent on subcontracting 2,498 companies, of which 1993 or 80% were small business concerns, was \$144,618,082. Of this, \$117,818,756 or 81% went to large business and \$27, 617,325 or 19% to small business. Of the \$147 million received by large business, however, \$181,000,689 went to the five major subcontractors—Ford Instrument Division of Sperry Rand Corp. for guidance and control; Rockwell Division of North American Aviation, Inc. for propulsion; Republic Motor Co. for turbine shells; and Blount Aircraft Corp. for jetter ground support equipment—much of it was in turn subcontracted to other companies. No breakdown is available on how much of this went to small business. Evaluating the \$181 million that went to these four contractors, small business directly received \$17,617,325 of the remaining \$145 million, or 10%.

It had the advantages of the newly-developed Rocketon system and its proponents earlier planning for Jupiter to come on, but it had the disadvantage of having only 12 months left in its time schedule.

Tactical planning conferences and training conferences followed quickly, and in February of 1953 the 554th went into training at the Army Ordnance Guided Missile School here. In March the Air Force's "Topic" or Joint Liaison Office, was set up at Army Ballistic Missile Agency headquarters here to represent USAF's Air Materiel Command, Strategic Air Command and Air Training Command.

Tactical Operations

Last August the first tactical Jupiter missile was turned over to USAF and last Dec. 15 USAF personnel demonstrated the tactical operation of the first missile system, combining the Design Engineering Inspection and the Contractor Technical Compliance Inspection. Although some elements of Col. Erb's 554th, located at the Army Ballistic Missile Agency, were in the area last December to begin phased deployment drilling, nothing in time schedule.

The fact that negotiations with Italy and other North Atlantic Treaty Organization members had not been completed by then apparently did not alter the training and support deadline.

A second Jupiter squadron, the 556th, was activated last July and began train-

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Propulsion through the ages...



Continued from page 40

An astounding propellant — not a matched set of firing nozzles, but the 1103 diam of a combination airframe-fallopies for George Cuyler. After various setbacks, the four men were moved to the pitch, then working from wing-to-wing stages for lead flight, propulsion provided by two guiding propellant assisted. A headwind feature recommended the strategy. A technical feat, however, is that the brilliant Vortices made the last powered heavier-than-air craft — the small late-

after stories above the hands of an advisor. A later featured film is that Rotol people designed, developed and produced the propellers for the first turbo-prop aircraft by 1944 and came this fact supplied turbo-prop to over 100 nations and aircraft operators throughout the world who used to Rotol aircraft. Rotol prop is standard equipment on the Vickers Viscount, Fawcett P-21, Grumman Gulfstream and many others.

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ing just after Christmas. Its training time will be considerably shorter than that of the 56th, because complete Jupiter systems will be available throughout the period and because this cycle has been telescoped through feedback that the 56th was able to make to the school.

The 82nd Strategic Missile Squadron (82SM) has no operations and a maintenance officer here now, observing the other units and preparing for activation of their squadron sometime this summer.

To add, Detachment One of Strategic Air Command's 704th Strategic Missile Wing (704SMW) is based here to help provide continuity in the training mission and the being of the USAF troops.

A Jupiter squadron consists of 15 missiles and about 500 men. Missiles are deployed three to a site at five sites northwest around a Rectangular Region-Missilebase area at distances up to 100 mi.

A launch crew consists of one officer and two airmen who control the three missiles at one unit site. These 25 men could launch 15 missiles. The three-man launch team operates from a Launch Control Trailer located far enough away from the missiles to be safe from a possible explosion.

There is virtually no possibility of an explosion of the nuclear warhead, which is not armed until a long sequence of steps — including flight — have been performed.

Squadron Organization

The squadron is organized into operations, material and maintenance sections and includes about five Jupiter specialists. The operations section is broken down into five "flights" or groups of launching crews. In the case of the 82nd, they are designated Flights A through E.

Each flight consists of five officers and 10 airmen. Since each 15 men are assigned to launch the 15 missiles, the total of 75 men means that each missile is manned in a five-to-one ratio — so that crews are available for three shifts a day on a 24-hr day, with a spare crew to take care of breakdowns and another to take care of new or late.

SMC's goal is a 15 min reaction time shot to target.

About 50% of the 500 men in a squadron are technicians and the remainder are in maintenance, supply, security and other functions. The ratio of five to one holds for both airmen and officers.

A Jupiter deployment requires about 18 vehicles and a "main pool" holding orders around the base of the unit. Transporters and cranes can move more than one missile, and a Launch



everything
worked fine...
**UNTIL
POWER
FAILED**
for just
5 seconds

"We had five fuel moving bagboys in radar contact and had started the defense process. Then... power failed. In five seconds we were back in business, but our scripts showed only four targets. We passed on the information. Defense got all four... but the fifth got through."

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Progress in Space Technology

How General Electric delivered first U.S. operational re-entry vehicle

General Electric Missile and Space Vehicle Department helped USAF Ballistic Missile Division solve re-entry problem . . . speed their operational readiness.

CAPABILITIES DEVELOPED RAPIDLY—Early in 1955, General Electric's Missile and Space Vehicle Department began research and development work on the highly important re-entry phase of the USAF ballistic missile program. A skilled core of G-E scientists with hypersonic and missile technology experience were pulled together from all parts of the Company. Special research tools were developed and put into use at MSVDC's new Aerodynamics Laboratory. Advanced shock tunnels reproduced high Mach air flows—10,000 to 25,000 F plasma jets simulated extreme re-entry heats. With such new tools, G-E gained vital knowledge of the re-entry environment.

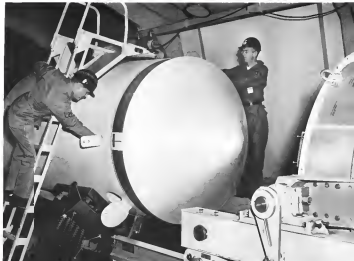
FLIGHT TEST PROVIDED DESIGN—MSVDC engineers were convinced that the best way to develop the Air Force with an operational weapon at the earliest possible date. Later, flight tests proved the soundness of the General Electric approach. On schedule, only 18 months after research and development began, the Air Force launched the first world's first operational re-entry vehicle on Thor.

Missile and Space Vehicle Department engineers were also able to make important advances on other fronts associated with the

re-entry challenge. Complex re-entry vehicle ground support equipment was developed; rocket-aided tests aided in solving firing problems. It was also necessary to build one of the country's most advanced data processing and computation centers to keep pace with the need for rapid processing of Air Force re-entry data.

PRODUCTION ON SCHEDULE—To prepare for Thor missile re-entry vehicle production, General Electric acquired and developed special manufacturing facilities and techniques. Proof of the unusual, rapid transition from research and development to production is the fact that Thor re-entry vehicles have passed all operational qualifications tests and are being delivered on schedule to the Air Force for air lift to key overseas bases.

ADVANCED NOSE CONE DEVELOPMENT—Meanwhile, development continued on more advanced re-entry vehicles. Last year, one such G-E re-entry vehicle, the Thor Able, successfully re-entered an air BMD zone of over 3500 nautical miles. With more than four years of success as a associate contractor on the Atlas, Thor and other programs, General Electric is the leader in re-entry vehicle development and production experience. This proven competence will continue to grow as MSVDC applies its re-entry experience to the expanding list of new missile and space projects. Missile and Space Vehicle Department of the Defense Electronics Division.



A GENERAL ELECTRIC RE-ENTRY VEHICLE is mated to a Thor Missile in the first SAC operational test flight mission from Vandenberg Air Force Base.

Official U.S. Air Force photograph



NATION'S LARGEST PLASMA JET FLAYS KEY ROLE in providing information leading to the solution of the re-entry problem. Plasma Air Arc and many other re-entry research tools were developed by MSVDC Aerodynamics Laboratory scientists.



OVER 175 YEARS OF FLIGHT TEST EXPERIENCE on Atlas, Thor and Thor Able missiles has been gained by General Electric covering both head-on and oblique types of re-entry vehicles for the USAF. These Thor Ballistic missiles are pictured above.



RE-ENTRY VEHICLES ARE ASSEMBLED at MSVDC facilities in Rockford, Ill., for both Thor and Atlas ballistic vehicles.

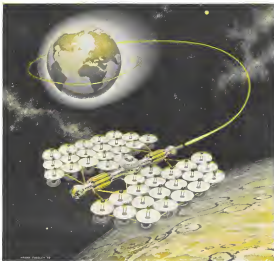
These Free Booklets Describe MSVDC Ballistic Missile Re-entry Vehicle Work.

Indicate the brochures that you would like to have and send to: Section A22H-54, General Electric Co., Schenectady, New York.

Completion of G-E's Missile and Space Vehicle Department _____ GEA-4914A
Space Technology Program _____ GEA-4876
Heat Sink Nose Cone _____ FIB-2
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Cosmic Butterfly

Spending its wings to absorb the stellar fire of solar energy is the Cosmic Butterfly, a space vehicle with a function conceived by Dr. Ernst Stuhlinger of Redstone Arsenal. Each of the fifty flat, parallel mirrors on the wings concentrates the Sun's rays on a tank at its focal point. Stored is deuterium, which drives a 200 kw turbo-generator in the base. Guided by liquid outer space in heat differentials, the whole vehicle is used over and over again.

The current three presented shows the main propulsion unit; on the right is which powerful electric fields accelerate charged particles, shooting them from the rear of the rocket exactly as the elec-

tron gun in your TV set bombards the screen. Sunlight, then, is the power source, whereas electron tubes propel.

While the model itself is relatively small, the wingless vehicle is operating at a vacuum and the path is enough to enable the Butterfly to reach interplanetary speeds. Unlike conventional rockets, the Butterfly is under power the entire trip. Helium tanks extend and burn around, and the ion thrust is used to slow the craft down to arrival speeds.

Since its thrust is entirely inadequate to power with the gravity of outer planets, the Cosmic Butterfly never lands. It is

assisted at stops and shuttles between artificial satellites.

The Cosmic Butterfly could carry two passengers and 50 tons of cargo from an Earth satellite to a comparable one orbiting around Mars in about one year at continuous thrust.

Initial navigation systems will play an increasing role in the exploration of outer space. **ARMAS** now providing such systems for the Air Force ATLAS and TITAN 3000's, will be in the vanguard of the race to outer space. **ARMAS** is located in Garden City, New York, a division of American Bosch Arma Corporation.

AMERICAN BOSCH ARMA CORPORATION

Control. Under cover, three vehicles, but which vehicles must be equipped with each mode.

Launch crews can impact and maintain accuracy of their equipment but more complex tasks require mobile maintenance crews. One maintenance crew is stationed at each launching position on a normal daylight shift, and two crews are available to be dispatched from the Redstone Arsenal Main Gate, as well as ground and wing shifts to emergency.

Mobile maintenance crews and the launching crew, kept at the Redstone Arsenal Main Gate, are far from critical of the number, can be recharged.

With a succession of training maintenance crews could be shifted to launch crews. USAF plans to train a succession of crews to other jobs when possible. With some training, mobile maintenance crews could also be trained for other operations. However, except in the propulsion area, maintenance personnel would require extensive special training.

Training Cycle

The 56th's training cycle was broken into four main phases. Since the Army's 4th Air Artillery Group was almost through with its Redstone training, and since Jupiter training was not yet available, Col. Eklund's unit was sent into individual self training on the 38th Air Group Redstone on Feb. 15, 1958.

Next came crew training on the Redstone, which is similar to components and almost identical to the as the overall system goes. This was followed by individual training on the Jupiter and South is Jupiter crew training at the Integrated Weapon System Training with a large closed field on the Redstone. Several ground training courses, replacement of a Jupiter rocket, training staff at the Integrated Weapon System Training site, emergency proximity of egress from Chrysler Corp. joint construction for the Jupiter.

When the 56th is deployed overseas, it will go on a technical training squadron and not as a strategic missile squadron. Troops of the North Atlantic Treaty Organization already are countries that accept the Jupiter will send technicians to Redstone for individual training and then return them to Col. Eklund's squadron for crew training. A small field detachment from the Training Command has been trained with the 56th and will remain with it through NATO training.

Control of nuclear warheads will increase with U.S. troops. The squadron will have with it about 40 contractor field experts. The group would be reduced to one year to about one-third

that number. Chrysler would decide the position of Chrysler personnel to those of Redstone Division of North American Aviation, Inc., the engine manufacturer, Ford Instrument Division of Sperry-Rand Corp., the guidance, manufacturing, and so on.

The 56th's situation differed from that training in two important ways.

• **Jupiter training** is conducted in military technical schools, while that of Thor is conducted primarily in air brigades.

• Since no NATO troops had agreed to take the Jupiter, a complete USAF squadron had to be organized around the Thor, a cadre of USAF personnel was trained and then sent overseas to the task of training the British troops who are deploying the Thor.

About 95% of the squadron's training has taken place at Redstone, but most personnel have had additional training at the Army Engineer's 24th Signal Corps (training) plant at Ft. Belvoir, Mo., and USAF's 10th Air Group at Vandenberg AFB, Calif. Check-out and maintenance of warheads has been taught at Lowry AFB, Colo. by USAF personnel who have trained in Army's 4th Air Artillery Group.

At Fairburn Arsenal, some of their work involved training more in and more with squadron crews and often self-reliance. Since the 56th has been trained by the Army and the Air Force, the 56th at the Air Force Missile Test Center's launching complex at Cape Canaveral, Fla. There

is a program, still in development, that calls for squadrons to be Jupiter from Cape Canaveral under operational conditions, and there is opportunity in the Jupiter program for this.

Once the squadron is in place, a few more at a time would be retired from Cape Canaveral for firing. Some Air Research and Development Command personnel have gone through the actual. They would remain at Cape Canaveral to maintain continuity, accuracy and checking out the missiles and training them over to operational launching crews.

Proficiency Maintained

Before the 56th was ordered to deploy it went a few hours and more than two days of proficiency, by reviewing training taking part in small groups to research and development group with Army Ballistic Missile Agency's launch crew at Cape Canaveral, and searching in checking out and preparing of Jupiter systems for overseas deployment.

The 56th crew supply, advanced and maintain the weapon system and staff, but it will need a special squad for looking, transportation, maintenance of vehicles, etc. It will follow the Strategic Air Command bombing concept of always being attached to a base.

The deployment concept also follows USAF policy of allowing squadrons to travel with the squadron if possible, especially where there may be to service them. It is not the intent of the United States to operate overseas.



JUPITER's producer and control components are basically the same as those used in June 1958 space probe. Computers and other instruments were made by Ford Instrument Division of the Sperry Rand Corp. for Army Ballistic Missile Agency.



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The Hughes 21" storage[®] tube offers you a new level of sophisticated displays for: Air traffic control, Combat situation plotting, Radar, Large-scale read-out, Medical diagnosis, Industrial television, and Slow-scan displays. This new television tube provides high light output, integration abilities, full gray scale, controllable persistence, and a very large display area—all in one envelope!

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of high speed digital character display. The 21" storage[®] tube is ideally suited for any of your digital read-out requirements. In addition, this unique television tube offers you either character read-out or spot reading mode—or a combination of both capabilities.

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amount of work, having reached a peak and leveled off last November.

All Indian air provisions are fresh and equipped, supplied through Commander Tank Automotive Command, with Boeing-McDonnell manufacturing most of the larger ones and Loran-Couch and Truck Co. the smaller ones. Other contractors include Walter Meyers, Inc. and Carter Wright Corp. Tires are made to Chrysler's specs with modifications including lockers, air conditioning, electrical fittings, etc. Freshfield Tires Co. provided all the inside tires.

An example of how the nation's contracting works is the Electrical Equipment Trailer, the most difficult, expensive and critical of the going. Research and development was provided by Army Ballistic Missile Agency and Honeywell. Most of the work was done by Honeywell, with the trailer built by Loran-Couch and components being supplied by North American Aviation, Precision Aircraft, Norda-Ketter Division of United Aircraft Corp., Ford Instrument Division, etc. Chrysler was in going to build the price of equipment.

Component Supplies

Chrysler supplies the bulk of the testing and servicing equipment for the Boeing-Inspection Maintenance and Precision Aircraft supplies most of the testing and handling equipment for the workload. Vertical test cells are supplied through the Group of Engineers by Boeing & Research, Inc.

The 6,000-gal. fuel accumulator is supplied by General Steel Tank and the 4,000-gal. liquid oxygen accumulator and liquid oxygen nitrogen governing plant are supplied by Air Products.

Lorain Co. Division of Union Carbide Corp. supplies the nitrogen service trailer. Chrysler and Honeywell supply most of the access platforms, ladders, cable mast assemblies, liquid oxygen replacement air materials, etc.

Walters, Annual supplies the location to Chrysler for outfitting. Component testing equipment is provided by Chrysler's test North Electric Co. and is located to vehicle supplies. This is done to maintain as few parts as possible.

Army Ballistic Missile Agency personnel was forced to considerably accelerate the test documentation, production and supply facilities because of the unusually short time from research and development to vehicle production of ground support equipment.

This stage was preparing detailed agreements in which service and which tests in Europe would supply each small detail and testing items in depositions, in deciding whether a service would be flown by USAF from one European

location to another as caused by the Army to issue.

By September and October of last year basic was no doubt that the D-15, 51 deadline would be met. Both services credit the success of the entire operation to a very high degree of cooperation, and both Air Force and Army men at the working level in the Japanese peninsula speak of this cooperation with a good deal of pride. None of the histories generated during the operations at higher levels of roles and missions and relative values of weapons systems is evident now in the developing agency or the using squadrons.

WADC to Research High Heat Compound

St. Louis, Mo.—Wright Air Development Center has contracted with Monsanto Chemical Co. for a research quantity of a polyphenyl ether for testing in a high temperature functional fluid. The polyphenyl ether was developed for USAF for possible use as thermally stable lubricants, hydraulic fluids and greases. Monsanto has synthesized as the polyphenyl ether compounds for service over a temperature spectrum of up to 800°F (AW Sept. 20, p. 37).



THIS IS ENGINE E7692

Airwork never scrabbles engine parts as a mass production house. When this engine was torn down for overhaul, the parts went on the cart. The cart kept all re-usable parts together as they went through Cleaning, Inspection and Rebuild. Now, new parts have been issued. The work is ready to start through Assembly.

These parts preserve your investment. If a vital part has a potential 50,000 hour life—and you have

used it for 1,000 hours—that's the use that goes back to your engine. Under the usual shop system, you would end up with a 5,000 hour part... and a big bill next time. Making parts that have "no life" are re-used. And... you get individual functional of the operating problems shown by the actual condition of your engine at overhaul. Only Airwork offers this value-validated overhaul method... the best you can get anywhere.

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Lift, drag and static stability characteristics of this model of a manned capsule are studied in the full scale tunnel at Langley Research Center, National Aeronautics and Space Administration. Objective is to find optimum shape of the Project Mercury capsule.



Small-scale model of a Redstone with man-to-space capsule and escape system on nose (above, left) is tested for lift, drag and static stability in the Langley Research Center's full scale tunnel. Wind tunnel. Model is suspended. At right shows the escape system and capsule alone undergo wind tunnel testing. Parachute models are being used at the Phillips Aircraft Research Station at Wallops Island for reliability tests of the escape system, aerodynamic studies of the capsule-escape combination, correct alignment of escape rocket nozzles and dynamic forces on the capsule and escape arrangement during launching and descent.

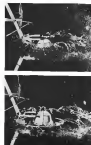


This Project Mercury capsule model is the actual model used in the first escape system tests at the Phillips Aircraft Research Station, Wallops Island, Va. (AW Mon. 34, p. 37).

NASA Tests Models of Man-in-Space Capsule and Escape System



Water landing tests of a reusable mockup of a man-in-space capsule concept are conducted at Langley Research Center. Inflatable capsule will carry a parachute and survival gear.





Martin P6M SeaMaster employs Republic Titanium

**FOR STRENGTH,
HEAT-RESISTANCE,
WEIGHT-SAVING**



The P6M SeaMaster is being built for the Navy by the Martin Company, Baltimore, Maryland. The aircraft employs 15 different

for analyzing and photo-transmission. Photo shows a titanium center beam used in each engine nacelle.

Two factors enabled The Martin Company to smooth the way for rapid, economical transition from design and development to production and delivery of the SeaMaster. First, was far-advanced planning on the prototype. Second, was adherence of the latest engineering principles, production concepts, and materials, including Republic Titanium.

Employing commercially pure titanium and titanium alloys, the SeaMaster contains more than 500 titanium details. The largest is a formed sheet metal bellhead measuring 36" by 48"—probably the largest detail ever formed from titanium at the time it was produced.

Commercially pure titanium and titanium alloy types supplied by Republic are used for strength, heat-resistance, and weight-saving. The titanium alloys are among the strongest now being produced and offer high strength values at elevated temperatures. In fact, titanium alloys provide the highest strength-to-weight ratio of any construction metal.

Many types of metals are required to meet the varied requirements of both aircraft and missile manufacturers. Metals so resistant to heat and corrosion, to reduce weight, to add strength. Production of these light weight metals is a Republic specialty.

Republic metallurgists and engineers are always available to work with your personnel in developing the most advantageous use of Republic Titanium, Stainless Steels, and Alloy Steels. The coupon is your invitation to arc this obligation-free service.



REPUBLIC ALLOY TORSION STEEL most designers require metals for operating and structural parts that must be free from excess weight, yet tough and strong to withstand shock, impact, stress, and fatigue. In these quality steels are found the highest strength values—plus an exceptionally high strength-to-weight ratio that permits the use of thinner, lighter sections to save weight and hold down size without sacrifice of strength or safety. These essential qualities were the basis for selection of Republic's Bellhead 4841 (ASTM A242) for compressor rotor discs in jet engines. The discs are machined from forgings by the Taper Group, Brownson-Ross Workholding Inc. Forgings were supplied by Wyman Gordon Company.

REPUBLIC BUILDING STEEL Types 221 and 202, are used by Sals Aesch Company in fabricating complete modules for Navy F2V patrol bombers. Stainless construction offers a number of advantages including less maintenance—no galvanizing and corrosion, greater strength, ability to withstand high temperatures, the use of lighter gages to save weight. These types are readily formed into desired shapes by the most convenient methods.

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Squadron of all-weather twin-jet Yak-25 fighters (NATO code name: Flashlight A) is lined up on an operational airfield in Russia. The square pattern of the runway concrete is typical of older Russian airfields. Flashlight A is in the high subsonic speed range and is the standard Soviet operational all-weather fighter.

Soviet Yak-25 All-Weather Fighter Operational



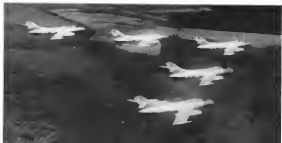
Large nose radomes and canopy installations are visible in photograph of Yak-25 formation. In addition to the canopy, the Yak-25 has a retractable belly bay for long folding-in, expanded sub-bail-out rockets. Some versions are equipped to fire air-to-air infrared guided missiles from external containers.



Yak-25 all-weather fighter available (above) from a Russian airfield during an operational practice. Note the high set horizontal stabilizers similar to earlier MiG-19 fighters design, and fixed-off landing gear, indicating the absence of air being concerned.



Airframe cleanup of Yak-25 (right) shows fuselage seating arrangement of pilot (above) and radar operator. Both are equipped with oxygen masks. Radar console is visible in the rear cockpit. Skirted bulge on lower fuselage houses 37 mm. cannon with slat designed for supersonic operation. Relatively small diameter and low bulge of about 5,000 lb. thrust, is probably the same type used as the engine of MiG-19 (AW April 5, p. 20). Note large-diameter fuselage nose radome, indicating both wide angle and long-range search and target tracking capability. Low level fuselage plan of Yak-25 (below) shows the vertical fin under the wing fuselage and two wing fences outlined of the engine nacelles. The top of the vertical fin contains a radar antenna. The supersonic success to the Yak-25-Flashlight C appeared in prototype form in 1956 and has not been observed in operational units.





A SALUTE TO THE WORLD'S LARGEST HELICOPTER OPERATION

A flight line of almost 700 helicopters... that's Camp Williams, Texas, where U.S. Army Aviation and its entire combat support, including Army, turn up in numbers as many as 700 to meet helicopter pilots each month. The size of the Army Primary Helicopter School and the whole story by way of service. Camp Williams, without military aviation management has achieved an unmatched safety record and a maintenance time to flight that tops all other 1955 Hiller fleet that is one-half that of the military average. It proves, too, that a Hiller H-29 is as rugged as it looks.

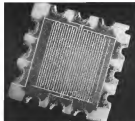
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AVIONICS



RADIO receiver, at left, built from nine RCA Micro-Module elements, achieves component densities approaching 480,000 per cubic foot. RCA says it can soon supply 15 different Micro-Module circuits. Resistor made from semiconductor material is at right.



New Techniques Shrink Avionics Size

By Philip J. Klaus

New York—Significant new developments in micro-manufacturing and solid-state circuitry which promise 10 to 100-fold reductions in the size and weight of avionics equipment were revealed here during the recent annual convention of the Institute of Radio Engineers.

• **Team Instruments** demonstrated solid-state circuitry in the form of a two multivibrators and phase shift oscillator, each fabricated from a single crystal of silicon, which may permit the replacement of component packaging densities of 25 million parts per cubic foot. Figures of roughly 15,000 per cubic foot are obtainable using today's best micro-manufacturing techniques and components (AW May 30, p. 352).

• **Radio Corporation of America** reported that its Army-sponsored Micro-Module program, one set a year old, has advanced to a point where one square inch can provide 15 different functional circuits in Micro-Module form in simple quantities for use by defense electronic equipment producers. RCA says Micro-Modules should permit component densities of up to 480,000 parts per cubic foot.

• **Servomechanisms' Donald W. Moore** said that it was soon to be possible to use thin films of evaporated metal ions to perform most of the logic and memory functions of a digital computer, opening the way to a simpler size and weight reduction. The prediction is based upon

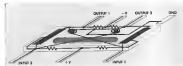
newly discovered magnetic domains in silicon in evaporated metal ions. RCA Corp. said, its evaporative deposition techniques, under Office of Naval Research sponsorship, was first reported by Avionics Week (Sept. 30, 1957, p. 78).

• **An Research & Development Council's Carl C. 31** Levin demonstrated

a solid-state light-emitting multi-bit, developed by Westinghouse Electric Corp., which occupies only 0.001 cu in., weighs only 0.02 gr., and consists of a single semiconductor element with only two soldered joints. Levin said that his firm is now negotiating with industry for major projects to demonstrate feasibility of solid-



TIME computer flip-flop (top center) produced from a single silicon crystal is one of the 1957-1958 micro-modules developed by Team Instruments, Inc.



TOPOGRAPHY of new substrate semiconductor circuit layout, and corresponding schematic diagram, are shown above. Different circuit functions, which can be achieved using semiconductor materials, are shown below. To date, semiconductor equivalent of an isolator has not been found.



Formed by applying etching or non-conducting materials to a semiconductor wafer.



Formed by utilizing the capacitance of a relatively large area of P-N junction.



Formed by combining the relative and capacitive elements.



Formed by utilizing diffused-base transistor techniques.



Formed by diffused-base methods.

state circuitry, or molecular electronics as it prefers to call it.

Transistors made out of the multiple semiconductor materials, and the capacitive effects of a large-area P-N junction to fabricate complete circuits including transistor and diode functions in a single semiconductor crystal.

Controlled Masking

Using controlled masking, etching and diffusion processes Transistors have come up with a tiny multi-layer which measures only 1.5 by 1.5 in., performing functions that normally would require two separate transistors, eight resistors and two capacitors. A pin-pointed circuit, which previously would use one transistor, five capacitors and three resistors, has been fabricated in a single crystal of approximately the size dimensions.

Companies have not yet been able to come up with a semiconductor functional equivalent of an isolator, which limits immediate circuit applications, but appears it is working on this problem.

Transistors already is working with several capacitor manufacturers to develop solid-state circuits to meet their specific needs.

Spiderman predicts the use of the new elements in development will enter within a year.

Companies say it can provide single quantities of its existing solid-state devices, for evaluation by component designers, within several months.

Micro-Modules

Radio Corporation of America's progress and the extent of supporting activity by combined component manufacturers surprised many observers at the IRE convention. In less than a year, RCA and its partners are expected to have come up with a stage of functional circuitry in Micro-Module form as well as basic components in this 0.1 in. square silicon which are the building blocks from which the Micro-Module

is actually fabricated. RCA says it will be able to supply engineering samples during the second half of the year at the following functional circuits in Micro-Module form for evaluation by defense electronic equipment manufacturers:

- Binary decoder.
- Gate.
- Intermediate frequency amplifier, for frequencies of 4.5 mc.
- Limiter, for operation at 43 mc.
- Discriminator.
- Audio amplifier.
- RF amplifier, for operation at 43.4 mc.
- Mixer, for operation at 43 mc.
- Sawtooth generator, for operation at 5 kc.
- True modulator.
- Oscillator, for operation at 392 kc.
- Clapper.
- Pulse shaper.
- Output amplifier.
- Pulse generator.

The Micro-Modules which RCA has contracted to date were designed for use in a Vorn Module version of the Aero's AN/PRC-16 radio set, AN/TCC-26 base-driven multiple equipment, and AN/TG-5 coordinate data set, which then being designed as general purpose circuit for wide industry application.

Micro-Module Components

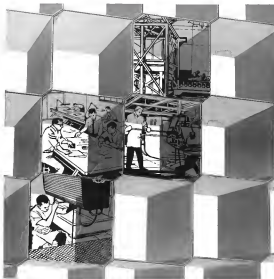
More than 20 component manufacturers have submitted sample components in the new wafer form fabricated by RCA's in-house.

These include:

- Bendix: Allen Bradley, Crayola, Chicago Telephone Supply, Corning Glass, DuPont, Dynatron-Watson, Glen Products, and Mullin.
- Capetronics: Arcon, Magavon, Mullin, and Spence Electric.
- Inductec: ARF Products and RCA-Northern.
- Transistors: Philco and RCA-Semicon.
- Thelco: General Instruments, Holla-Semiconductor, Pacific Semiconductor.
- Crayola: Midwest Manufacturing.

Range of component types and values which are currently available, according to data released by RCA, is as follows:

- Resistor: Deposited thin film 21 ohms to 180,000 ohms, 1 watt, with temperature coefficient less than 290 ppm/C. Max. metal oxide film resistors 20 ohms to 180,000 ohms, thin with temperature coefficient less than 200 ppm/C.
- Capacitor: General purpose thin film circuit, single layer with values up to 5,000 picofarad at 180 v.; multiple layer, up to 0.1 microfarad at 50 v. Precision thin film circuit, single layer, up to 29 microfarad at 100 v.; multiple layer up



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ROHR brings years of know-how into the tremendous B-70 team effort... including advanced design and manufacturing capabilities in stainless steel, titanium and structural composites which have been under way since 1947 more than five years.

As a wide contractor with engineering, research and development, manufacturing and test responsibilities for complete wing components, ROHR becomes one of the major B-70 team members.

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The Red Knight of Germany

(Continued from Inside Back Cover)

Manfred von Richthofen, destined to become Germany's greatest ace of World War I and leader of the Royal Prussian Jagdstaffel in missions as a leading pilot. In 1916, British troops came to call the man and planes of his Staffel "Richthofen's Flying Circus."

Von Richthofen scored his first kill as the ace on the morning of September 17, 1916, by shooting down a two-seater British fighter plane behind the Germans' third line. He celebrated his first victory with champagne, then ordered the first of a collection of engraved silver cups from a jeweler in Berlin. Each cup won to mark another victory. In less than two years, this calculating virtuoso scored 80 kills and 126 successful missions.

The Germans are keen by the book, not by instinct. A former cavalry officer, von Richthofen transferred to the German air force to be near the front lines. He failed his first solo flight and later crashed up two airplanes. Fokker before being assigned as a fighter pilot.

Von Richthofen's fame grew fast in the autumn of 1916—the exact year we entered in the history of the German air force. In the first half of 1917, Allied air losses cost four times greater than those of Germany. In "Bloody April," 305 British aircraft were destroyed. Most of these losses were attributed to the Fokker Triplane, designed by a Dutch engineer, Anthony Fokker. Fokker's bank swung Dr. I triplane compensated for its lack of speed through high maneuverability. It could climb quickly, turn sharply, and perform stunts in combat.

The first day Germany's Red Knight flew a Fokker Dr. I, he shot down a British plane, with only 25 minutes of ammunition. The last day von Richthofen flew a Fokker Dr. I was a challenge—April 11, 1918. So he and other pilots of the Flying Circus pre-



GERMANY'S RED KNIGHT
...a champion pilot and ace of aces

(Above continued)



pared for the morning flight, a mechanic asked him to pose for a picture. Not seeing the famous German ace Oswald Boedike had been photographed just before his last flight would a German pilot permit his portrait to be taken before going to combat. But von Richthofen couldn't abide superstition; the pencil for the picture, slipped into his during the picture, slipped into his during the picture.

During a daylight over the Somme River, a single bullet penetrated his chest. The Red Knight of Germany was dead when his plane landed safely beyond the British positions at an Australian field battery near the Somme. The victory was credited to Captain A. Roy Brown, D.S.C., a 24-year-old Canadian flier on patrol duty.

Gone forever from the skies was the German who had shot down 30 planes in a 30-day period during the spring of 1918. At home, his mother passed a collection of 80 cups. Seventy-seven were silver, and the last three were made of lead.

There was no silver left in Berlin.

Heritage of the Air

One of the most inspiring chapters in the history of flight is the story of the man and his machine of World War I. It is a highly personal story of brave men—and the wind, wire and brain that converted manpower to aviation.

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Free Reprints for Framing... Color prints of the cover illustration of Fokker Triplane and other World War I planes are available for framing. Reserve a set of these collector's items—complete with scale drawings and specifications—by addressing requests to company letterhead to "Heritage of the Air, Leach Corp., 14435 Seward Road, Compton, California.

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to 1,550 mho at 50 v. Also, solid transformers electrolytic up to 90 mho, volts.

• **Inductor:** Temperature-compensated ferrite core, 4.3 mc. to 30 mc., up to 15 millihenries with "Q" greater than 100.

• **Diode:** Type 1N277 high current gold bonded Type 1N643 silicon, full-wave, a Zener reference, and a voltage-sensitive variable capacitance type.

• **Transistor:** Type 2N360, general purpose audio amplifier; Type 2N364 switching device; Type 1N184 VHF small signal amplifier, with 15 db gain to 50 mc. Also a VHF small signal amplifier with 10 db gain to 70 mc., and a VHF power amplifier for operation up to 75 mc.

• **Crystal:** Three quartz crystals are available for operation at 7 mc., 45.5 mc. and 70 mc.

• **Multi-function:** These include a multi-master mixer, consisting of two mixers rated 1 watt each, with temperature coefficient less than 100 ppm/V, an LC combination of ceramic capacitors and deposited thin-film inductors, and an LC combination of ferrite core inductor and ceramic capacitor. Multi-function resistors, with values of 10 ohms to one megohm, are being produced by DuPont-Walton using silver coated with semiconductor material on which are etched resistors that have which provide desired resistance. Resistance value may also be obtained by using multilayer elements, composite sets.

• **Harmonics:** McFarley says it has developed a mercury battery, measuring only 3/16 in. in diameter and 1/16 in. thick for use in a self-contained power source in Micro-Module. Company also is developing suitable potentiometers, ceramic capacitors and resistors for the Micro-Module program.

Mechanical Assembly

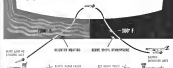
RCA says it is developing techniques for mechanized machine assembly of the individual sub-components into complete modules. At present, this is accomplished by hand using special jigs. Watson an interconnecting by means of wires along outer periphery which also provide structural support, much like technique employed for earlier Navy Project Trident modules developed by the National Bureau of Standards.

RCA says that 31 companies have indicated an interest in applying new Micro-Module to their equipment. Seven of these include six major semiconductor manufacturers and 25 are large electronic manufacturers. RCA says.

The Micro-Module program is sponsored by Army-Signal Corps and is being directed by its Research & Development Laboratory at Ft. Monmouth, N.J.

SIX Pacific CABLE TENSION REGULATORS

fly with the X-15 into space



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To solve this problem, six Pacific cable tension regulators were installed on the Spirit's back, between the first, third, fifth, and sixth control systems.

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MISSILES: 1959

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GRAIL WACE SHARD BOWARC FIREBEE TAIDS AN/USC2 PROUDS II

4

AIR-BREATHING MISSILES

All of these missiles are really planes without pilots—by which the main engine, fuel, and electronics necessary for the final mission. Some are pilotless bombers—Foster, Jet Vengeance, Jet Vulture. Some are interceptors and electronic spies like their distant cousin,

Robert. Hey, Inc. are the invisible ones which fly only to shoot down the dozens and the dozens of targets. These are fighter planes smaller than ever with maneuver planes in the cockpit, and here are the interceptors. Robert, the eyes in the sky over Scotland—transmission means to keep a sharp eye on hostile troop movements, troop concentrations and coastal ports.

Rheem AN/USC2 combat surveillance drone shown in lower left above is the most advanced pilotless aircraft for gathering information on enemy battlefield areas available in the world today. It is a ground high performance and low field commander and a vigilance. Search through in combat surveillance for the modern U.S. Army. High performance, early and reliability have been packed into the versatile, rugged and most economical vehicle possible. Developed and manufactured by Rheem's Defense and Technical Products Division for the Signal Corps, the AN/USC2 is flown in a steady climb, over the ground—four of these fly into a single standard Army track and each drone can be launched from a small standard Army trailer.

(No target is required). Rheem also provides major test components of the drone's telemetry and ground support systems which can be easily moved in standard Army trailers.

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Engineers: John K. Hines is challenging electronic work



SHARD TAIDS NINE WACE NINE HUGUES TUBER HAWK

5

GROUND-TO-AIR-MISSILES

These are the air-to-aircraft guns of the missile age. Fired at the point of our eyes, hidden in portable launchers, or fired from shipboard weapons, few of the U.S. defense missiles are truly new or first themselves at home. They encompass the

deepest power of the Strategic Air Command. In full production, these missile interceptors are more than a match for the missile launched jet or air-breathing missile. The interceptors in the missile launchers above the launchers, Army Missile Hennes, will be able to meet tomorrow's ballistic rockets on even terms.

Westinghouse is working on the missile problem of the space age—its missile guidance system to control for successful one-on-one entry in a practical power plant for the missile. With sensors of the interception missile missile capability.

At the Westinghouse Advanced Strategic Planning Group (WASP) scientists are determining long range guidance systems and space requirements—and planning weapon systems and programs capable of meeting these requirements.

The Westinghouse Aerospace Systems is exploring such areas as space collaboration, orbital intercept, space probes and satellite communications.

Westinghouse is spending \$115 million for research and development in 1973. Current projects which will count heavily in missile and spacecraft systems to come include: pulse Doppler radar in three major areas of application—air-to-air, including thermal imagery; electronic guided crystal detectors, and photoelectric diagnostic systems.

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GENIE SPARROW III JUMI SIDEWINDER FALCON

6

AIR-TO-AIR MISSILES

Armed with air-to-air missiles, and taking an airplane with the characteristics of a missile, the Genie fighter pilot is in a book in the control chain of a weapons system. He may even touch the missile from takeoff to landing—the first, the chase and the kill is done

by the black boxes that come along for the ride. The fighter pilot of the missile age does not even have to see his own shafts of destruction. Most will seek out and kill in hostile places or evade in spite of severe maneuvers—and the radar-equipped enemy will vaporize any aircraft within 3000 feet of their missile fury

High-performance missiles call for ultra-high speed bearings—and that's where rugged, compact Torrington Needle Bearings come into their own. Remarkably strong for their size and weight, Torrington bearings take the friction out of many types of missile equipment, such as control surface supports, bearings, ground and air launchers. Most bearings had designed from the start to handle precision tolerances with minute requirements in mind. Torrington bearings achieve highest capacities, longest life-spans, free state is remarkable in their economy in for their technical perfection.

Current Torrington research and development programs

promise to bring about rugged-and-colder bearings for increased operation beyond 330°F. Bearings of this type would find their application on missile hot spots—such as rocket nozzles, combustion chambers, jets and afterburners. Designs already evolved from the Torrington test program are actually ahead of most proprietary competitors. All the important data gathered in these advanced tests is available to designers. First out after Torrington's bearing after clearance and application as an early stage in your planning call at your nearest Torrington representative, or write: The Torrington Company, Torrington, Conn.—and South Bend 21, Ind.

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EQUIPMENT

Chamber Simulates Space Environment

By Michael Yellin

DuPont, Ohio—Universal test chamber to simulate all environmental factors from 75,000 ft and through interplanetary space is a new development goal of the Air Force.

Nest Odessa, Ohio State University is scheduled to complete a year-long study for Wright Air Development Center on planetary and interplanetary environments and methods of simulation. The report will present the latest facts and suggestions on environments—natural and induced—about which a vehicle would encounter in traveling through interplanetary space and in landing on other planets. It will detail methods of simulating these environments in a laboratory and then present plans for building such a facility, giving tentative layout, equipment required and probable costs.

Current Project

Current Ohio State project is actually a follow-on to a recently published Radio Corp. of America report for WADC on hyper-environments and methods of simulation, which covered the same topics for the region from 75,000 ft to 400 mi. Initiated just before the first satellite launchings, the RCA study concerned itself primarily with the air in which today's USAF weapons systems were expected to operate (AVR Mac 24, 1955, p. 73).

On the basis of these and some related studies, the Air Force is planning to ask Congress for money this year to get started on the national simulation. The RCA report estimated the cost of the original Hyper Environmental Test Facility at \$5,417,000 on a basis of engineering, land and utility costs. Extension of the simulation range to interplanetary conditions is expected to push the price of the unit—now tentatively called Hyper Environmental Multiple Research Facility—to about \$8 million. It will be about three years from the time work began until the facility is operational.

Simulation Subject of Study

The problems of nuclear environment simulation, considered a major program in itself, was made the subject of a separate Air Force sponsored study. This study, now completed, is serving as the basis for the Nuclear Engineering Test Facility, which is now under construction at WADC. Scheduled to become operational in 1959, this facility

will be a big unit that will be capable of simulating radiation, principally from nuclear, at altitudes up to 200,000 ft and possibly higher later. Simulation of the high intensity radiation belt above the earth, which was unexpectedly found up by the Explorer II satellite, will also be assigned to the facility since it bears some relation to nuclear radiation. Wright Air Development Center is also carrying out a number of studies, some in WADC to find out what combinations of environments can be simulated most effectively, which ones are no longer im-

portant, and of the new simulation programs proposed, which might better be assigned to existing facilities.

No Air Force study is expected to serve as a model blueprint for the final facility. Principal purpose is to provide Wright Air Development Center with a basis on which to request bids from potential contractors, who themselves may suggest more effective or less costly approaches.

Ideally, WADC's simulators would like to have a simulation unit in which they could place a complete Atlas or intercontinental ballistic missile or space



Radiation and neutron chamber at Franklinford will simulate control of 0.5 m. to 24 m. in beam and control wavelength as well as infrared and cosmic conditions. Deuterium-deuterium source which is continuously allowed to warm components, is oxidized through chamber. Windows are equipped with variable apertures.



Checking Republic surface-to-air missile prior to launching from experimental cart. For the use of Ni-Cr-Mo steel castings in the launching cart,

Chance Vought was judged a National Award Winner in the Third Product Development Contest conducted by the Steel Foundries' Society of America.

How castings of 4330 nickel-alloyed steel help boost a missile up, push assembly cost down

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Research L, made by Chance Vought, is normally loaded skyward from a rail launcher. The Navy, however, wanted a more economical launching technique that would utilize a carrier's powerful catapults . . . that would also simplify handling of the missile aboard ship.

The answer was the expendable catapult cart you see above.

The carts, also made by Chance Vought, are assembled with 30 cast 4330 steel detail parts welded to tubing of the same material. These castings replaced T3 detail parts required in the plate-type fittings of the experimental units used to prove the idea. They also eliminated 300 hardware items, such as nuts and bolts. Assembly is easier, and far more economical.

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ENVIRONMENTAL test chamber, built by Tenney Engineering for McDonnell Aircraft, will simulate temperatures from -100°F to 1,200°F, altitudes to 150,000 ft, and sea winds up to 100 ft/sec, at 75,000 lb. Walls are 3/4 inch thick steel enclosures with 1 ft. of foamed glass insulation in between. To get engine simulation, six 3-blade through two upper decks and intake through lower duct on opposite wall. Chamber cost \$500,000.

vehicle, put a punched card in a computer and have the chamber exactly reproduce the exact environmental pattern the vehicle would encounter if it were actually to fly the programmed course.

However, says Mr. Wright, Air Development Center scientist, the proposed Hyper Environmental Multiple Research Facility together with existing simulation equipment and the reduction and analysis contractors would give the Air Force everything it actually needs for this work.

As now planned, the facility would be located at Wright Air Development Center close by existing simulation units and would be used by the Air Force for its own experimental work. Among other things, it would be used to develop test chambers and means of simulation to meet test center requirements and be adequate simulated before any actual specifications are written.

Industry's Facilities

Industry, it is hoped, will have its own facilities, perhaps as a cooperative basis. Because various companies are interested primarily in simulation and not in the same kind of experimental work that the Air Force is required to carry out, a WAECI assembly points out, their could get by with only a unit comparable to the original Hyper Environmental Test Facility outlined in the recent RCA report and costing considerably less than the proposed WAECI unit. Either facility, of course, would be a big improvement over cur-

rent simulation methods and equipment.

At present, Air Force items are subjected to simulated environments as described in specification MIL-E-8972. Included here are such environments as shock, vibration, explosion, temperature, humidity and fungus.

But these environments stress the RCA report, are actually only valid for testing equipment to be used in present-day aircraft.

Future Weapon Systems

Future USAF weapon systems will be operating in different environments—natural and induced—from those now easily simulated today. These will be the so-called hyper environments which will be found at altitudes above 75,000 ft and below 400 mi.

For purposes of such study, RCA's R. A. De Tonde and J. J. Lorch selected the hyper environments having the most deleterious effects on flight vehicles of the future as those being the most important to reproduce in an environmental test chamber, proposed methods of simulating these environments, listed equipment required, suggested size and layout of the individual units, and gave estimated costs.

In most cases, of course, these vehicles that will operate at altitudes above 75,000 ft will also have to pass through the various environments from sea level to 75,000 ft, many of which will not be able to be simulated in a hyper environment test facility.

These environments that will have to be simulated separately, according to

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Hyper Environmental Simulation Facility

Condition	Test Unit	Altitude	Cost (1971)	Capacity	Remarks
High vacuum	Klystron, 4 ft. (diam.) x 10 ft., with pump	1,000 sq. ft.	\$200,000	6 x 10" x 10" (300 ml. without)	Ultimate goal is to approach perfect vacuum of space
High temperature	2 ft. x 2 ft. x 6 ft. steel vessel section heated by infrared heater	400 sq. ft.	\$110,000	1,000°F (can be increased if needed)	To be used for temperature shock and steady-state high temperature testing
Air testing	High altitude chamber through which rammed air is blown	2,100 sq. ft.	\$200,000	Air flow from 100 to 1,000 ft. min. from -80 to 200°F	To duplicate air testing of equipment from level to 100,000 ft. Above goal is increased flow at higher altitudes
Sever radiation	Vanadium decafluoride, 8 ft. x 12 ft., with various air pumps, vacuum and electric field equipment	1,000 sq. ft.	\$475,000	Radioisotope spectrum of 100,000 to 1,000,000 R./hr. and 400,000 rad range of gamma concentration up to 150,000 R./hr. ion densities of 200,000 R./hr. and 100,000 R./hr.	Altitude goals to simulate under water of water equivalent of 1,000,000 ft. to simulate maximum location of 1,000,000 ft. to simulate other planetary atmospheres when their 50 years known
Vibration	Three shaker tables in hemispherical configuration	1,000 sq. ft.	\$275,000	15,000 lb. force to 2,000 rpm, at 1,000 ft. or to 100,000 ft.	Will modify water forces and frequencies on future measurements facilities
Acoustic simulation	Endogenous noise chamber with noise, amplification and loud speakers	1,000 sq. ft.	\$400,000	Up to 174 db over 10 to 10,000 rpm with test in 100 ft.	Goal is to develop a high intensity noise based acoustic noise tests
Shock	Two hydraulic generator shock machines in hemispherical chamber	1,000 sq. ft.	\$40,000	Can shock in three mutually perpendicular planes at 100,000 ft. and altitudes to 100 ft.	Will modify shock pulse as measurements indicate
Acceleration	10 ft. radius centrifuge in test chamber with test rooms	5,000 sq. ft.	\$1,500,000	500 g with 1,000-lb. load of temperatures to 1,000°F	Plan to include vibration to 500 ft.
High-speed particles	Stage of large accelerator and projectile tube	3,000 sq. ft.	\$10,000	1-gon particles 10,000 ft./sec. up to 100,000 ft. and altitudes to 100,000 ft.	Altitude goal is to simulate particle speeds from 25,000 to 200,000 ft./sec. and velocities to 100,000 ft./sec.
Explosive decomposition	Shock tube, 8 ft. (diam.) x 20 ft., with vacuum pump	100 sq. ft.	\$45,000	Explosive shock wave	Nonlinear expansion generated (50 ft. g) equipment carbon from evacuated (10 ft. g) carbon

the RICA report are humidity, salt spray, fungus, and dust, explosive atmosphere, rain, and lightning storm. Except for the last, however, all these conditions can already be simulated at existing facilities at WADC.

Combined Environmental Testing

Another WADC report, "Feasibility of Combined Environmental Testing" by W. J. Ceres and G. Kellen, goes into detail on the important problem of combined environmental testing. Engineers have found that materials, structures and equipment that are with stand specified levels of temperature, vibration, altitude, etc., in individual tests often fail in actual flight where these conditions are combined.

In their report, Ceres and Kellen list the following combinations of environments as the principal ones required:

- Vibration, shock, blowing snow and low temperatures.

- Vibration with rain, sand and dust, combined at all speeds.
- Age at all environments of high or low temperature, altitude, temperature, condensation, temperature shock, acoustic, vibration, shock, and explosive atmosphere.

The RICA report does not consider the matter of adding these combined environments other than to point out that almost all the proposed hyper environmental facilities allow for additional building size.

As far as the environmental equipment manufacturers themselves are concerned, however, the manufacturers' divisions of different environments in regard to one of the most significant and most active developments in this field at present. They contribute to existing facilities, according to environmental engineers Frank Gordon of Tenney Engineering, Inc., will eventually be able to eliminate 50% of recurring

major test failures and set definitely the trend today.

Already a comparatively common unit at the aviation industry now is the new facilities, altitude-pressure-humidity chamber. One of the largest is the 12 ft. x 10 ft. x 15 ft. chamber Tenney has made for Space Graphics Co.

Temperature Range

The facility will have a temperature range of -100°F to 400°F, an altitude capability of 120,000 ft., and air circulation. The chamber machine will generate 15,000 ft. of force at 2,000 rpm per second.

Because of the vibrating unit, which Tenney doesn't make, the chamber cost \$150,000.

The next step, says the Space Graphics, says Tenney, will be the same combination of environments but with much higher altitude capabilities. They will come the addition of a reduction



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even, possibly in combination with some and separation with.

Another advanced simulation will be engine vibration, shock, and acceleration, which can be conducted with separation but none of the others in the first group. High speed particles and explosive decomposition will remain strictly individual tests.

Prior Use

With each combination of simulated conditions, of course, the price goes up. Recently, for example, a new case, set up for a 10 ft x 10 ft x 10 ft facility, which can be used for both personnel and equipment testing. It will be able to simulate altitudes from sea level to 50,000 ft, making the tests between from one to the other in 10 min. Temperatures inside the chamber will go from ambient to 1,200°F in 45 min, and from ambient to -200°F in the same amount of time.

In addition, the chamber will have a vent for simulating air radiation before takeoff.

Estimated cost is about \$600,000 just for the chamber. Adding engine power, \$55, and simulation costs could raise the final price to \$1 million. But, this is still only slightly more than half the estimated cost of the larger environment chamber already needed by aircraft and missile manufacturers and only about one-third the price of the one owned by WADC.

The rapidly increasing speed and of tests capabilities of modern aircraft and missiles have not only boosted the cost of simulating the environment, it's also increased the need for such tests. The rapidly increasing speed and of tests capabilities of modern aircraft and missiles have not only boosted the cost of simulating the environment, it's also increased the need for such tests. The rapidly increasing speed and of tests capabilities of modern aircraft and missiles have not only boosted the cost of simulating the environment, it's also increased the need for such tests.

Sharing the Boom

Sharing the boom with Taurus. The growing which is considered the largest in this field, are roughly 50 other producers and assemblers. Among the most important companies are a subsidiary of Hughes Aircraft Co., Inc., and the General Electric Co. division of American Motors. Most of these companies consider the business as a long-term investment. They could double the industry's total annual sales, they consider the growth prospects bright for the future.



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The Holley designed 2-1/2 Compressor Bleed Governor for the Pratt & Whitney Aircraft JT-3 and JT-3D Jet Engines.



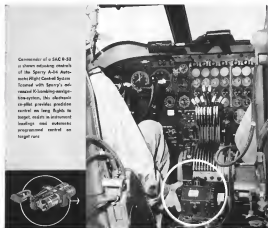
A compression to the accessory is the 2-1/2 Compressor Bleed Governor for the JT-3 and JT-3D Jet Engines.



Designed for Pratt & Whitney Aircraft's JT-3 Jet Engines, the 2-1/2 Compressor Bleed Governor is Holley designed and manufactured.



This bleed valve and actuator for the JT-3 Jet Engine is manufactured by Pratt & Whitney Aircraft design by Holley.



Commander of a SAC B-52 is shown relaxing controls of the Sperry A-44 Automatic Flight Control System. Scanned with Sperry's advanced Klondike navigation system, this electronic co-pilot provides precise control on long flights. Its target radar is instrument readings and automatic programmed control on target runs.

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Hydra-Power Corp., Piquette, New Rochelle, N. Y.

Turboprop Engine Mount

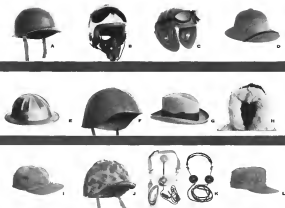
Rubber-insulated forged aluminum and steel engine mount is used to mount the Lycoming T53-L-1 turboprop engine on the Cessna 440 I observation aircraft.

Three NR 5000 vibration-dampers



Helicopter Rescue Hoist

Rescue hoist developed for the prototype Kaman OH-131 Navy utility helicopter weighs 750 lb. Hoist, using a five-layer cable rope to reduce speed rate, will lift a 600 lb. load at 120 ipm on a 180 ft cable. Hydraulic motor drive provides better weight configuration, but no electric motor may be fitted. Manufacturer is Hydra Electronics Products, Pleasanton, N. J.



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And as for the many hats, these shown above have been worn on these representative programs: **A** Integrated Battlefield Communications; **B** Supermarine Bombardier and Station Keeping; **C** High-speed Tank Range Finder; **D** Test Range Microwave Relay System; **E** Bellview Missile Radio Inertial Guidance System; **F** Shipboard Surface-to-air Missile Guidance; **G** Bomber, Army Scientific Advisory Panel; **H** DEW Line Air Defense Radar; **I** Strategic Bombing Radar; **J** Amphibious Landing System; **K** Shipboard Air Defense Data System; **L** Tactical Drone Guidance. For data on how Motorola's military experience can be applied to your problem... or for detailed information on engineering career opportunities... write to: Motorola, Inc., Military Electronics Division, Dept. A, 6801 East McDowell Road, Phoenix, Arizona.



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ing units are used to measure the engine.
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New Haven & Co., Conn.

WHAT'S NEW

Reports Available:

The following reports were upon request by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Polymer Derived From Dicyanogen-Benzene-Acrylate—by F. W. Kricheldorf and H. C. Hilden, Wright Air Development Center, U. S. Air Force, Dayton, 1955. \$1.00, 15 pages. (PB 151169)

Reference Index of the Current Fuel-Tested Contingency Specifications—Guidance—by T. K. Anderson, General, Detroit Arsenal, U. S. Army (No. Dtr.) \$2.00, 199 pages. (PB 151164)

Methods of Determining Surface Roughness—by M. K. Yezzerian, University of Alabama for Wright Air De-

velopment Center, U. S. Air Force, June, 1955. \$1.25, 46 pages. (PB 151163)

Investigation of Physical Circuit Methods for Reliability Applications—by H. R. Brice and R. L. Truss, P. R. Mallory & Co. for Wright Air Development Center, U. S. Air Force, August, 1955. \$2.50, 233 pages. (PB 151129)

A High-Speed Electronic Printer for Digital Computer Output—by V. Scott Grant, Rochester, Ill., for Wright Air Development Center, U. S. Air Force, November, 1957. \$2.50, 111 pages. (PB 151171)

Technology of Molibdenum and Its Alloys—A monograph sponsored by the Office of Naval Research, September, 1956. \$7.50, 16 pages. (PB 151193)

Selected Bibliography on Precision Instrument and Fluid Bearings With Annotations—by J. C. Wray, U. S. Naval Academy, Annapolis, March, 1957. \$2.50, 105 pages. (PB 151191)

Stabilization of Computer Circuits—by E. Hochstadt, University of Chicago for Wright Air Development Center, U. S. Air Force, November, 1957. \$1.00, 99 pages. (PB 151135)

Statistical Evaluation of Reliability Produced by Several Processes—by R. S. Shieh, The Martin Co., for Wright Air Development Center, U. S. Air Force, June, 1955. \$2.00, 66 pages. (PB 151165)

Research on Electro-Optical and Magnetic Core Logic—by F. C. Marshall,



P6M Part Milled on Numerically-Controlled Unit

Fitting in the main door of the Martin P6M Scanner was machined from aluminum alloy on a numerically-controlled milling machine in about one-third the time required for conventional milling. Operation is an example of application of the APT system of numerically programmed machine tools (AW Mfg. 90, p. 9). APT (automatically programmed tool) system was developed at the Servomechanisms Laboratory of M.I.T.



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by and L. J. Andrews, National Cash Register Co. for Wright Air Develop- ment Center, U. S. Air Force, Dayton, Ohio, 1957. 51 pp., 51 pp. (HS 511257).

Publications Received:

Dictionary of Astronomy and Astronautics—by Arnold Spett, coordinator of Visual Satellite Observations for the Smithsonian Astrophysical Observatory, Cambridge, Mass., and Frank Garret, contributing editor, *Encyclopedia Britannica*. Pub. Philosophical Library Inc., 11 E. 46th St., New York 10, N. Y. 56.00, 499 pp.

Definitions of over 2,000 terms and concepts related to astronomy and astro- nautics.

Scientific Publications—Edited by N. E. Hemeny, Bell Telephone Laboratories, Murray Hill, N. J.—Pub. Reinhold Publishing Corp., 450 Park Ave., New York 22, N. Y. 515.00, 767 pp.

A reference on the physical chemistry and fundamental physics of atomic nuclei, with tables of astronomical- ing materials.



Satellite Beacon

Navstar, low power transceiver sub- carrier module for transmitters, uniquely built to broadcast tracking signal and temperature data from the Project Scout "talking satellite"; now in available in production quantities from Applied Science Corp. of Princeton (ASCP). Transmitter, which has output power of 10 to 500 milliwatts, can be operated at any crystal-controlled fre- quency between 100 and 150 mc. The device is designed to be adaptable under load, but phase modulation at receiver frequencies up to 22 mc. can be employed. Transmitter measures only 3 1/2 in. x 1 1/2 in. long, weighs 12 oz. Total power consump- tion is 2.00 mw.

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where the North meets the South



End of a Magister butterfly tail section gets its slot in this assembly jig at Heinkel's Spyer plant.



Wing-chaper sections is skinned in aluminum jig between are very close. Over all wing width is 50 cm. of air.

Fuselage panel sections are unperforated. Shell components here are about pure aluminum thickness.



Controls, hydraulic and electrical lines and other accessories are installed in completed fuselage section.

Germans Produce Fouga



Rear section is skinned before final drying in this jig at Messerschmitt's Augsburg plant.



Completed Fouga Magister fuselages receive final cleanup and inspection on their scheduled, 10-hour run at the Messerschmitt assembly area at Augsburg. From here, fuselages are trucked to Muenchen-Koenig for final assembly and flight tests.

Magister Trainers

Germans built Air Fouga Magister CM 170R, two-seat jet trainer, now in service with the Luftwaffe, are being produced at the rate of about 50 airplanes per month. Fast deliveries were made from a batch purchased outright from the French designers. Subsequent aircraft are being produced by the Flugzeug Union Ltd. of Munich, a joint company formed by Ernst Heinkel Flugzeugwerke GmbH, and Messerschmitt A.G. Heinkel is responsible for production of wings, empennage and landing gear and fuselage sections which contain most vital and gear. These components are made at the main Heinkel assembly plant at Spyer in Rhine. Messerschmitt turns out the complete fuselage at its plant at Augsburg and handles final assembly and flight tests.



Luftwaffe students pilot their Fouga Magisters on a formation training flight over Germany. The aircraft has been standardized as primary trainer in all jet categories.

Leaving final assembly line, Fouga Magister gets final inspection before taking off on its initial test flight.



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Until recently equal difficulties for mounting radar receivers or microwave relays were of two types. One was a big and heavy amplifier with cumbersome auxiliary equipment; and the other was a sensitive though delicate instrument suitable only for the laboratory.

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Our gas noise sources may properly be called miniature. They require only inches of space, smaller, lighter auxiliary equipment, and small voltages and currents. Around 500 volts free them; 100 milliamperes maintain them. These characteristics, plus others, have caused them to find numerous applications: for in-flight calibration and test of aircraft

microwave receivers; as miniature workhorses on airborne radar systems; and in other systems which require various simulators to vibration, shock, humidity, and temperature cycling.

The Litton family of miniature gas noise sources, like all Electron Tube Division products, was designed to solve specific and new functions. We have found that this philosophy contributes to consistent reliability: tubes do their jobs more efficiently, for longer periods of time, and at lower overall cost to the buyer. Other advantages also result. For example, these noise sources require no agencies and the L-2000 is replaceable in the field without changing the mount.

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Hail tore C-130's nose cone, cracked windshield panel.

Hailstones Severely Damage C-130 Transport; Crew Unhurt

Short burst of hailstones, estimated at only 30 in., severely damaged a Douglas C-130 transport but the aircraft continued to fly for 100 mi. before landing safely. All four Pratt & Whitney T34 engines functioned normally although oil cooler was heavily damaged. Crew and the hail storm never appeared on the SPN-59 radar. Most serious immediate danger came from flying glass, leading edges of wing also were damaged, necessitating a landing inside it a speed slightly higher than normal. The C-130 was heavily loaded at the time. Repair will require about 14,000 man hours. There were no injuries.



Hailstones hit the C-130 with such force that wing leading edge was pitted in several sections, and badly dented in others.



Glass shatters from windshield severely scored plexig.



Nose leading edge and intakes were dented by hailstones.



Force of hailstones resulted in this propeller damage.





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New Min-Klad insulation may well be the most significant advance ever made in thermal and radiant insulation.

Developed by Johns-Manville research scientists, Min-Klad is the only product of its kind, a permanent insulation of the malleable variety's two most effective high-temperature materials: 1) reinforced plastic and 2) J-M's recently developed Min-K insulation.

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lower than the malleable conductivity of still air. And this conductivity (already less than half that of the best Fibrous Insultherm) drops still further with altitude. At 10 miles, for example, it is decreased by as much as 50%, with further decreases at greater altitudes.

Wide range of applications

Min-Klad offers the malleable and malleable designer a rich choice of heat-control possibilities. It may be used for a part that must insulate, yet have the structural advantages of plastic. Where requirements call for a malleable, low-cost, permanent insulating surface... or for a good insulating bond between Min-K insulation and other surfaces. Or, it may be used to control high transient

temperatures! For high heat capacity of asbestos-reinforced plastic combined with the low conductivity and heat capacity of Min-K insulation is a product that provides maximum heat transfer under transient conditions.

Min-Klad is now being tested for approximately two dozen missile and rocket designs. Why not investigate for your present thermal requirements? Upon request, we'll be pleased to send you a sample of the material along with detailed technical information. Write: Johns-Manville, Box 14, New York 16, New York (Ask for information on Min-K insulation and the new aviation insulation brochure TM-1854.) In Canada, Fort Gould, Ontario.

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BUSINESS FLYING



NEW COMMANDER 264 being put KC-135A jet tanker pilots up how military air clubs are building up modern private plane fleet.

USAF Clubs Boost Lightplane Markets

By Ervin J. Balkus

Rapid growth of new clubs in the U.S. Air Force, encouraged by enthusiastic support from high-ranking jet pilots, is providing an important morale-building factor for service personnel, but also has developed into an important market for the business aircraft industry.

Also evident is a trend toward greater ability of the airplane by the growing number of Air Force club members, with attendant purchase of high-performance equipment to supplement air club training vehicles. Starting out as a basic or low-level lease-purchase opportunity for fun and relaxation, the military air club is developing a hard core of people, many of whom have never flown in a lightplane before, with the desire to use the private plane in a casual form of private transportation for touring and vacation.

SAC Aero Clubs

Detailed figures are not available on the overall size of private and business-type aircraft by club members at the various U.S. military installations, but some striking guidelines are afforded by a look at the organizations being developed at USAF's Strategic Air Command bases here and abroad.

Aero clubs are now established at some 10 SAC bases in the U.S., Spain

and Labrador and their membership rolls total approximately 3,500 military and civilian personnel attached to those stations operating some 750 light aircraft of all types.

Each of the Command's aero clubs is directed by a board of governors and the president of each club is a representative to the SAC Aero Club Association, which meets periodically to report on club progress and to lobby for formation of new clubs.

The annual meeting of the association also is attended by manufacturers of club-type aircraft and equipment makers who display their products.

During the annual Aero Club Association meeting at Offutt AFB in September, a

representative of Champion Aircraft, Inc., noted that some 15% of the new plane's total sales in the past year had been to SAC aero clubs. The next annual association meeting is scheduled in December at Barksdale AFB, La.

Largely of the organization is the pioneering operation at Offutt AFB, Omaha, Neb., headquarters of Strategic Air Command. Formed in 1950 with the enthusiastic support of Gen. Curtis E. LeMay, then commander of SAC, the Offutt Aero Club began with a single Piper Super Cub. Today it operates 17 light aircraft, has some 300 members and expects to reach about 400 in a month, according to Col. Marcello E. White, president of both the Offutt Aero Club and of the SAC Aero Club Association. Col. White credits the aero clubs with being a "trend-setting asset" to any SAC base and states that they are a major factor in occupying the spare time of their personnel and in maintaining their interest in military service.



COL. M. E. WHITE heads aero club.

Approximately half the Offutt aero club's members are officers, of whom half are staff pilots, the others being rated observer and navigator. The other half of the members are enlisted men and civilians attached to the base. Approximately 20 of the members are civilians, including seven women.

Membership rules are kept to a minimum and any officer, aviator, civil

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a shilling, when costs and budgets are tight. The tendency to pick a Lycoming engine-powered boat was also put down because of SAC use this existing experience which indicated that this type of engine had been the operating job between aircraft compared with competitive types and also a considerably lower overhead cost, American West was told.

With a continued number of Comanches going into use this attitude, members are extending their legs, at Offutt AFB then single into Canada and Mexico. A recent two-Comanche excursion from Offutt earned an approval and a briefcase of interest as a rugged pleasure boating expedition into South Dakota.

Club memberships are transferable in one position once to another but, a paid-up dues receipt and membership card is all that is necessary. In the event a member goes on extended leave past due date, he is placed on inactive status and continues to pay dues, but as a reduced scale.

Club members high school, standard, chief executive, instructor pilots or designated check pilots at each club conduct all checkout flights in each engine and check pilots are required by the chief pilot prior to becoming a checkout pilot and are subject to checks. Check flights at Wichita, for example, are conducted when an pilot has not flown the airplane in 30 days. He is required to make three flights prior to naming passengers. If the pilot has not flown the airplane in 60 days, the field check includes a minimum of five solo flights and a corresponding number of landings.

Night flying checks are given if cross-country flights will encompass such a requirement. A night flying check is done in a 190 mi. cross-country flight with an instructor. Clubs have a flying safety board which includes the line flying safety officer and other qualified club members.

Lycomings to Power De Havilland Heron

Tallent, leading and most special characteristics of the four-engine, de Havilland Heron turboprop transport are expected to be admirably improved with installation of 148-hp. geared and supercharged engines in place of standard 190-hp. de Havilland Gipsy Queens. A modification engineered by Vult. Av. Corp. de Mexico for Banco Nacional. Purpose of the conversion program, the modification company expects, is to provide the Heron with improved inherent characteristics from high altitude operations in Mexico. According to Banco Nacional plans, the Heron of gross weight of 13,950 lb. took

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Alouette II flies exclusively with AC Spark Plugs! It takes peak performance to span the path between Mt. Denali and Mt. St. Elias. It takes reliable spark plugs! Alouette flies this route because of AC.



Alouette Chief George Smith, left, with Alouette II. Smith is the first to fly this route with the new AC Alouette II.

Mountain Chief George Smith offers this information: "Tells about extreme operating conditions. Alouette has been extreme weather—extreme temperatures—and some electrical stuff. For extreme reliability I like AC Spark Plugs. AC 281 performs like a hot spark plug in our DC's. It delivers power in some of the most rugged conditions due to fueling. It also helps to conserve fuel and no combustion problems caused by low pressure oiling. You, it has AC spark plugs. AC Spark Plugs for the planes you fly! Call them from your AC supplier, TDS471."

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First Photo of Cessna Model 210

Cross speed of 190 mph is indicated by results of nearly complete flight test program on new Cessna 210 four-place business plane, which enters its final testing phase completely into the design. Cessna expects to get Federal Aviation Agency type certificate and production approval this month, will officially unveil the airplane to the public in September. Powered by a four-cylinder Continental 280 hp. engine, price of the plane will cost around \$21,900 for a standard-equipped model. Cross speed indicates that the 210 will be in competition with Piper's low-wing Comanche 235, standard version of which is priced at \$19,999.

also means for takeoff than a Douglas DC-7 at Mexico City. The field is 7,400 ft. above sea level.

Cross speed is also expected to be increased from 180 mph to better than 200 mph and maximum rate of climb characteristics also will be improved. Takeoff gross weight will be increased to 14,500 lb. with the new Licensing Cessna 210 210 hp. powerplant.

Construction cost of approximately \$90,000 is expected to be less for better performance because of experience gained from initial modifications.

Installation. Bendix-Pacific, in letters to distribution and manufacturers notes that these higher values have been discovered. Final modification on Aero Design Comanche 235 and Comanche 235 through 210.

Bendix-Pacific states that the all-legal counterfeits can be identified from its own part by the blue and red marking bands. Bendix-Pacific Part No. 015140 is finished in a black, zinc-plated.

Following notification of the other

two by Bendix-Pacific, Aero Design & Engineering Corp. agreed to notify Federal Aviation Agency of the existence of the illegal counterfeit and also to send a mandatory bulletin to all Comanche distributors to ensure the Bendix-Pacific compliance from the legal valves installed on their aircraft.

Bendix-Pacific have long been a problem to operators and aircraft dealers working with surplus aircraft in some cases the parts being revealed surplus unapproved items.

Bendix Warns Users On Counterfeit Valve

Counterfeit duplicates of a Bendix-Pacific Bendix-Dwight Inc. operated power brake valve, although have been found in circulation in the marketplace, which is warning users and distributors that it will not furnish parts for overhaul of their units and will not assume any liability in event of malfunctions or failures of the brake system.

Not only are the brake valves duplicate of Bendix-Pacific Bendix-Dwight Inc. No. 40346, but the alleged counterfeit also has placed both Bendix part numbers and Bendix-Pacific nameplates on the stem, indicating to the operator



Red Chinese Build An-14 Transport

Red Chinese version of An-14 (Little Red) light transport was reportedly built in Peking in 60 days. Aircraft is designated Capital 2 and carries eight passengers.

1219

month \$15 per month has been developed by Nova-Tech Inc., Marlborough, Mass., for purchase at its corporate. First set up Nova-Tech Aerospace Corp. to handle future jobs.

Service operations belonging to Aircraft Electronics Assn. will hold their annual meeting April 30-May 1, at the McAllister Hotel, Miami, Fla.

Fiberlite AeroDyne spin tool, started in manufacturing to produce 360 lb. of lift when aircraft is doing 90 mph, is going into production in 119 gal. 71 gal. or 68 gal. capacities and

will be available for installation on Piper PA-18A and Champion single seat airplanes. Two engine systems permit spend out on special order, to permit power of dual engine engine. This is built by Dakota Aviation Co., Haines, S. D.

License agreement to produce Dornier UH-5 helicopter in Italy at price of approximately \$100,000 has been negotiated by Dornier Helicopters, Inc., Dearborn, Conn., and Dornier-Helicopters, Rome.

Ability of approximately four million pounds of cargo to load up and sup-

port a log of drilling rig in Guatemala has been started using three surplus Lockheed C-130 Hercules transports each carrying 15,000 lb. Equipment is being moved from a periodic field in a strip 110 mi in the jungle. Helicopter-based Brown Drilling Co. is drilling the exploration well for Oil Co. of Guatemala, Standard Petroleum Continental Oil Co. and Union Oil Co. of California.

Larger tanks holding 47.5 gal. of motor fuel, have been approved by Bell 471 Ranger helicopter. New tankage increases 471's range to approximately 410, the company reports.

Export of de Havilland Canada twin Rotax and Otter single-engine utility planes during 1955 totaled 17 of the former type and 14 of the latter out of total total deliveries of 25 and 28 respectively. Since delivery of Rotax began, in 1945, de Havilland has exported 1,871 out of 1,290 delivered through 1955, including 550 R-20s for U. S. Army since start of Otter delivery in 1952. 771 have been exported out of a total of 299, including 193 for U. S. Army.

Expansion of facilities at University of Illinois Urbana Airport will be made using a \$12,000 reconstruction division to build a T-hanger to house several executive aircraft. Current construction includes a \$120,000 terminal building and control tower.

"Fly it yourself" team of West Europe have been developed by Air France in cooperation with Comair, Mondon de Virolog, which will quickly increase its transportation. Air France air line from U.S. to Paris and then arrange tour participants to use Piper Tri-Pacer lightplanes to visit historic sites. Each of four team will average approximately 51,000 including transatlantic flight and American land ocean activities.

Pilot proficiency training program is coordinated by 98% of lesson plan; operations a series, conducted by Flight Safety Foundation, N.Y.C. indicates Return of 50% of questionnaire sent out by FSF also indicates 42% of companies conduct their own training programs and use outside facilities in only 50% use only their own programs and 10% use only outside programs.

Learning engine with constant speed propellers will replace OH-105 engines and fixed pitch propellers in Australian built OH-105B transport being manufactured by the Flying Doctor Service in that country.



Sikorsky HSS-2 twin turbine engine anti-submarine warfare helicopter first port aircraft crewed in high speed run. Pilot's window, open, visible, not visible forward, view at the start of the fly-in at the company plant at Stratford, Conn. The helicopter's engines are the OH-105A T10 (AW Mar 30, p. 10).

Navy's HSS-2 Demonstrates Amphibious Capability



First test landing in water in the Housatonic river (left). Water landing characteristics are shown in two (right).



HSS-2 hoisted before touchdown on land (left). Split cabin door with steps in bottom section in ready (right).

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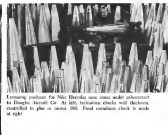


Five stages of Nose Hercules nose cone production at Bedford, Conn., plant of Lycoming Division, Aero Manufacturing Corp., are at left foreground starting with flat blank, perforation, first and second spins and finished spin. At right is a hydrospinning machine which has a capacity of up to 60 in. in diameter. Method eliminates welded joints.

Lycoming Uses Nose Cone Spinning Technique



Flat blank is placed on hydrospin machine (left) and, if correct, now is ready for first spinning. First spinning is made with air right. Two hydrospinning controlled work rolls at left foreground are diametrically opposed, creating a perfect round. Spinning also produces a fine microfinish. Cores are made of 6062 aluminum.



Lycoming produces the Nose Hercules nose cones under subcontract to Douglas Aircraft Co. At left, technicians check wall thickness, straighten to plus or minus .005. Final visual check is made at right.



Sealant is applied (left) to the lower part of a B-52G wing center section at Goodyear Aircraft Corp.'s plant at Lindbergh Park, Ala. At right, ribs, spars and panels are placed in position in the B-52G wing center section takes shape in a final assembly jig.

Goodyear Fabricates B-52G Center Wing Section



Final assembly of the top part is shown. Components that make up the top part are aligned in the final assembly jig where they are brought to be spliced in the fuselage. When assembled, sections are perforated and sent to Boeing's Wichita, Kan., division.



At Boeing's Wichita Division, a center wing section is loaded into a wing pig (left) that is loaded between the two main wing pigs. Another view of the center wing section (right) shows its relationship to the wing pig as assembly of components begins.



The B-52G wing begins to take shape after the center section and the main wing sections have been loaded into the jig. Ribs and between-ribs are then beach devices for subcontractors to start that can form a wing section over the entire to bottom ribs.



Completed wing section is about to be lowered to the B-52G fuselage (above). Site of the center wing section and the load that it carries is apparent. Drawings are included (below) to make the space between wing and fuselage. The top panel which covers a portion of the center wing section is similar to the one shown in final assembly in the middle of the opposite page.



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Bell Tests Obstacle-Information Radar

By Craig Lewis

FL. Waite-Dell Helicopter Corp. is testing a new terrain clearance and ground mapping radar here which fits a eye in helicopter instrument flight capabilities by providing obstacle information for operators close to the ground.

The radar was developed for the Army-Navy Instrument Flight (ANIF)

No. 4, 1977, p. 96) by Bendix-Pacific Division of Bendix Aviation Corp. It is one of a series of sensors Bell will eventually combine to produce an integrated all-weather instrument flight system for helicopters.

Bendix radar will provide navigation information for the system and will give it an obstacle warning capability. Ability to avoid obstacles in all weather conditions is currently a gap in both

copter instrument flight systems, and adding this capability will permit all-weather routing operations between destinations, as shown and in similar low altitude situations.

Radar system is designed to operate over a 10 mi range for ground mapping and up to five miles for obstacle avoidance. The system weighs 75 lb.

Target Location

Bendix radar is a Ku-band pulse radar using phase comparison for accurate location of targets in the vertical plane.

The selected radar signal is received by two slotted arrays, detected by dual mixers and amplified to dual IF channels. The signal is then phase compared and produces information derived. The unique antenna is 1 ft wide and 40 in long. Bendix says the narrow dual slot array design is less than one-tenth the area of an equivalent resolution parabolic dish-type antenna. The antenna's 0.1 arcsecond pulse width and one degree azimuth beam width provides high resolution.

The antenna array consists of 85 angled slant slots in the waveguide. Anomalous beam width is one degree, and elevation beam is 0.5 deg for searching. Elevation beam width is produced by two scans which form a beam with a vertical aperture of less than 1 in. Phase-coherent antenna provides a signal which facilitates terrain clearance information through a two-phase comparison technique. The system includes two amplitude-modulated phase-tracking IF amplifiers and a phase detector.

Antenna Mounting

The antenna is mounted in a cushion on top of the cabin and forward of the rotor mast. Three mechanism controls it through a 160 deg sweep at 60 cps. Ground mapping information comes from the whole scan, but obstacle information is taken only from the 45 deg forward segment of the scan.

This segment is limited by the requirements of the display, not by radar capability.

Mounting the radar antenna on top of the BHF-1 (H-1) helicopter rotor mast causes interference in the rear 30-deg segment from the mast and tail rotor structure, but it is superior to a belly mounting because it provides information on the ground and in between that could not be provided from a belly position. And getting the antenna under the helicopter would also make it vulnerable to ground damage.

Receiver transmitter and power supply for the system are housed in a case

that is 20 in long and less than 11 in wide. The transmitter operates at 50 MHz, with peak power at 18,500 megawatts and a repetition rate of 1,000 pulses per second. Pulse width is 0.1 microseconds. Input power is 28 volt direct current, 715 volt, 400 cycle three phase, and five megawatts can be used by available power on helicopter and small fixed wing aircraft.

Bell is now using infrared display to test the radar system's capabilities. One is a monochromatic cathode ray tube display that is used for obstacle information only, and the second is a color side view tube display that shows both navigation and terrain clearance information. This second display shows terrain features in red and green. An obstacle that is below the criterion of the system's green, while obstacles above the criterion are red, indicating possible danger.

The optimum set of displays for the integrated flight control system have not yet been determined, but the Bendix radar will transmit enough information on the operators display that it shown on radar display.

Navigation Display

Eventually the system will have a navigation display operating the Pilot Position Indicator (PPI) scope used in the instrument test display, perhaps with the addition of an overlay. This optional display will use the Bendix radar to map the ground for navigation purposes. Utility of the two color scheme is to tell the pilot whether terrain features are potential hazards or being ignored.

Obstacle information from the forward segment of the radar scan will also be presented on the vertical flight control display which the pilot will use in the integrated system to fly the machine in instrument conditions. This display will probably be based on an optical system developed by Aeroast Division of North American Aviation.

The obstacle display is a large loop which presents everything in perspective a narrow wavelength in the green section of the light spectrum. The low contrast the light display projected to the navigation and presents a grid pattern picture to visualize the ground.

The display presents its picture with vertical depth so that, unlike cathode ray tube displays, a pilot's eye doesn't have to adjust from close to distant light in the transition from instrument to contact flight.

Obstacle information will be presented on the vertical display at the proper angle and distance to an eye object will have the correct range perspective. The antenna is defocused, established



Price Cutting vs. Economy

Competition can be the life of progress; industrialism price cutting, the death of it.

One of my favorite stories concerns the farmer who had to cut costs in order to compete successfully in the market place. He ultimately cut the ration of oats consumed by his male each day. This he did over a period of time and, although the male "thinned" about it, the farmer continued to demand a full day's work from him. The economy of the reduced ration pleased the farmer, but the male died of malnutrition. Even when customers "kick" about prices, manufacturers must avoid, at all costs, the nature of industrialism price cutting to remain competitive. It is our responsibility to lead and eliminate the sources of waste in our operations in order to hold prices down. We must adopt all possible improvements in engineering, manufacturing and marketing techniques. This approach is the only feasible means of providing improved products at lower cost to the ultimate consumer.

In the current race for technological breakthroughs occasioned by the advent of the Space Age, we component manufacturers must design and produce, within a realistic budget, the required equipment at a reasonable price. This "price" cannot be arrived at by arbitrary price cutting if we are to remain solvent. We must convince buyers and contracting officers that 1. A reasonable price is necessary to perpetuate a business, 2. Prices must allow for convenient replacement and obsolescence, 3. Prices must support a reasonable Research and Development effort.

If we fail in this task, it is conceivable that the buyer will devote some time morning to find that the male is dead.

George J. Pardigues
President



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SADOME covers Bendix-Pacific radar mounted on Bell H-1 (H-1) research helicopter.



CLOSUP of radar installation with radome removed shows antenna configuration.



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to the obstacle ship will move with the display pattern, rather than remaining stationary as the display.

The radar system has fixed range scales of 3 mi., 5 mi. and 1 mi. It also has a flexible range feature tied to altitude in which range scale automatically varies 3 mi. to 1 mi. as altitude decreases during a landing.

With this "rubber range" feature, the pilot has a mental picture of the area when flying at altitude and a large picture of the immediate area when he is at airport level or landing.

In a demonstration of the Bell plane here with the antenna rotating about 10 ft. from the ground, the various display clearly showed helicopter



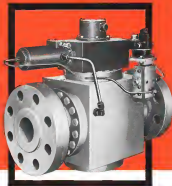
New Ceramic Tubes

Family of new ceramic vacuum tubes, designed for operation at temperatures of 1600° which has been developed by Gen. and Electric was displayed for first time at recent Institute of Radio Engineers convention alongside the type 7077 (bottom photo lower left), a UHF triode currently in production. The Z-2187 (top left) is a UHF diode, the Z-2192 is a cold-cathode voltage reference diode, the Z-2204 is a high gain triode, the Z-2154 is a power triode; the Z-2194 is a low thermal version of the type 7077 triode; the Z-2155 is a high ohm triode for radio or radio frequency use; the Z-2154 is a power triode; the Z-2185 is a high ohm triode with a 25,000 ohmohm transconductance; the Z-2152 is a vacuum tube for use for AF or RF applications and the Z-2127 is a power pentode. Application of new vacuum tubes includes a cathode 1,200 mc. RF amplifier (photo at top) using the type 7077, which has a 15 db. gain and 6 db. input figure and a five-stage microstrip-frequency amplifier, operating at 40 mc. which also uses the 7077 triode to provide 74 db. gain and a 3.2 db. second-stage noise figure.

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A prime contractor of U.S. Defense Department.

BUSINESS ACHIEVEMENTS:

PART -
F-1 Phantom - First all-jet airplane to take off and land on aircraft carrier.
F-4 Phantom - Famous Korean War fighter jet.
F-105 Mustang and F-106 Sabre - First jet fighter to convert to supersonic flight.
F-106 Sabre - First successful conversion from helicopter to airplane flight.

PRESENT -
Texas - the airframe and power plant of this missile designed and developed at McDonnell.
F-101 Falcon - Holder of three transcontinental speed records, the F-101B teleoperator now in quantity production.
F-101 Falcon - Missile carrying all weather Navy fighter now in production and fleet service.
F-101 Falcon - Production award winner for March 20 all weather Navy fighter now in competition for a multi-purpose, 4-jet trainer-transport. McDonnell speeds over 100 m.p.h.
F-101 Falcon - Development and quantity production of an electronic and sub-systems within minutes.
F-101 Falcon - McDonnell just awarded contract by U.S.A.F. to develop and build F-101B Mustang teleoperator capsule.

FUTURE OBJECTIVES -

McDonnell will continue to diversify and intensify its efforts in all areas of engineering research, development and production, related to air and space vehicles for our Armed Forces.



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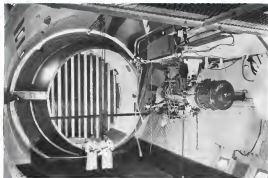
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T64 Tested Under Propeller Driving Conditions

General Electric T64 gas turbine engine (AW Max. 35, p. 38) is evaluated in developing test cell at company's Small Aircraft Engine Department, Lynn, Mass. Test cell is housed with T64-400 engine test cell output gas and a 120 ft. long vent duct. It has 12 ft. of ductwork leading to each end for noise suppression. Cell was built to test the T64 under actual propeller driving conditions.

sonics Corp., San Diego, Calif., investigation of stresses on "Personnel in Free Field" (JPL/AFOSR 60-117) 101-171.

Radio Laboratory, London, England, is conducting research on "Theoretical Study of Antennas of Space Propulsion" (JPL/AFOSR 60-117) 101-171.

The University of California at Los Angeles, Los Angeles, Calif., is conducting research on "Theoretical Study of Antennas of Space Propulsion" (JPL/AFOSR 60-117) 101-171.

The University of North Carolina, Chapel Hill, N.C., is conducting research on "Theoretical Study of Antennas of Space Propulsion" (JPL/AFOSR 60-117) 101-171.

The University of Texas at Austin, Austin, Texas, is conducting research on "Theoretical Study of Antennas of Space Propulsion" (JPL/AFOSR 60-117) 101-171.

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Navy Contracts

Following is a list of awarded contracts for \$25,000 and over as released by U.S. Navy contracting officer.

DEPARTMENT OF THE NAVY BUREAU OF AERONAUTICS, Washington, D.C., is conducting research on "Theoretical Study of Antennas of Space Propulsion" (JPL/AFOSR 60-117) 101-171.

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For consideration, please send your resume and references to: Mr. J. H. Smith, General Motors Corporation, Warrendale, Pa. 15090. Please do not call.

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LETTERS

Weather Reporting

After sealing the account of the recent electric accident and near electrical fire "The Cost of False Economy" (AW Feb. 9, p. 11), the point should be stressed in the Electric section that could be gained in power with additional funds in the method and accuracy of weather forecasts.

Minneapolis-based, of a 400-page book, "2 no umbrellas left over and hope" You can't have fog and 2 no umbrellas come to the other, but not both. Everyone talks about poor weather reporting but no one does much about it. More advance should be given to pilot reports and there should be scheduled weather hops to get accurate reports as could be accomplished by helicopters or light aircraft. It would certainly be nice to get an assessment of what the weather is worse than reported and opposite weather reporting has been responsible for more than one fatal accident, oil spills and other risks.

One area which many leaders could help earth would be that of weather reporting. Less search of distances and altitudes from the field, not by good guesses from a point on the ground, which is not hazardous. Being in reporting forward visibility is so important as the Electric and others. Visibility into the sun is a hard one to be reported in 1 mi and usually less than 1 mi to the point. Common sense shows much of the uncertainty of weather reports but any pilot needs to be optimistic or he wouldn't be in the air.

H. B. Davis
Berkeley, Calif

Electra Procedure

One point seems to escape comment in the continued discussion of the LaGrande Electric district. With only an 8 mph. wind, isn't it really a good idea to divert the light to the comparatively bareheaded but coarse-hinged neck to gain a 16 mph. advantage in ground speed over the safe standard?

CHARLES C. LUTHELL, JR.
Engineering Associates
The Green Group

Defense Expenditures

Occasionally your editorial policy seems very one-sided and you might ask if you are really serving the local picture. *The Dunbar Mirror*, Feb. 2, is an example.

The validity of your arguments could not be denied if the only difference between us had been military. However, as we know, there is also a serious economic threat, and this too appears to have a devastating potential. In order to survive, we must be alert to all threats.

Class defense portion is not imposed solely by the expenditure of real money. The need is for wise spending. Other things are important too. For one thing, somebody had to pay the bill—and at all costs there cannot be any more interest in money.

Some of the economists just complain

domestic Week endorses the opinion of its readers on the taxes raised in the magazine's editorial columns. Address letters to the Editor, *domestic* Week, 348 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a positive identification. We will not print anonymous letters, but names of writers will be withheld on request.

don't we actually want to delete child development or double-up programs? Someone has to sit at the drafting table. If that "someone" happens to be the Administrator in Washington, D.C., I am badly for them.

Please do not confuse this as discrediting a life time's hard work. I have been for several years, and will continue to be, a faithful subscriber.

James H. Anderson
Chicago Falls, Minn.

Money-Mad Philosophy

After reading your editorial "Research and Responsibility" in the Feb 15 issue of *Science* (*Wired*), I am in complete awe on the truly far-reaching accounts each of the typical online content.

The author captures today's life in a very small world of his own. It resonates himself by an egotistical complaint and mixes with philosophy of life. This story can easily be perceived by the people, because it is real, clear, and explains our situation. Right against, right wrong, and all the other wonderful and sad things people who make us a successful and creative society.

That might sound scary, sharp and severe, but I assure you I have good reason to be. The accounts for I am a expert with one of the largest armies serving around the world.

It is truly pitiful that the university system backed up by the Air Land White House's threats of strikes etc. cowardly have not on the scheme of all the writers.

The elderly stressor captures a forcing bias by not fully getting the percentage and measured salary. The salaries of both are both staying for greater service and value, regardless of what these policy get when we are the competition online. This is making MAPA a business method for combining the value added, which is not a heavy value added into their company great happen associations.

I will not go into the realm of elaborate overloading of dangerous techniques and combinations that elicit a panic response because there is one exposed chestnut, but I will go as far as to say that you and the American air forces haven't seen anything real, relative to the recent bombings and terrorist incidents.

The previous paragraph is a prediction of the terrible and most unfortunate accidents that will follow upon the outbreak of new wars.

So you can see that if the real system has a
 heave to provide through the cable, a well
 qualified pilot will act at the controls in the
 right way.

"We are closing my letter to you. Via Elton let me say that the nation's industrial, political and better way-up to the new and different thing technology shared. The old thing of 25-30,000 lb of thing and 10 tons old or older hasn't got a single thing as he can't work of "improvement" to apply to the great, electric, transit, class and for down procedures, get across with respect for safe and efficient operation.

It is the opinion of this writer that ALFA should start paying a decent staff of public relations people to meet again with and convince the public on ALFA and the nuclear plant problem. The recent strikes over pay, free component and being hired have now done terrible damage to the attitude of the public towards us all.

Budget Comments

In the latter phase trial was finished

Click on the editorial page. Your comments on the federal budget indicate a lack of vision and understanding of the type which has played our economy so greatly. The federal budget has been planned to enable the U.S.A. to use either an economy or standing war. People who are not thoughtful enough to see this do not deserve public representation at all.

Your recent comments on airline pilots have been swamped. In selecting a few so-called outliers you have lost collection on the entire group.

Charles E. Burrows
Turkey Hill Road
Ithaca, N. Y.

Alignment Credit

We were very pleased to see the program station join give to the nonprofit alignment (localities, and their important role in helping to ensure the success of long-range mission (SM, Feb. 2, p. 71).

There is one additional point that deserves mention. That is that the probable theodolites we produce for the Jupiter have developed much more slowly than Bell's.

developed jointly with the Asia Pacific Music Agency at Redhouse Annual. The group there, under Dr Walter Hamsarawan, Peter Mielke, and Henry Rode, was responsible and deserves credit for the successful development. One responsibility was to develop and produce materials to meet the highly positive response.

Unfortunately, there was an oversight in setting this among the several rules when we originally prepared the material and had it cleared through the appropriate agency.

CARLTON W. MILLER
General Manager
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THE RED KNIGHT OF GERMANY

Brilliantly, colored German Fockers ruled the skies in 1917, firing in tight formations introduced by a young Prussian soldierman whose all-crest plane identified him as the Red Baron. He was

Continued on page 110



CARLTON W. VILLER
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COMMAND DECISION ON TAKE-OFF



Human engineering principles dictated how take-off information should be presented to the pilot in Servomechanisms' new and advanced take-off monitor. The monitor presents take-off data on servo-driven tapes, freeing the pilot from mental data processing—yet he makes all the command decisions throughout the critical take-off roll.

The ingredients for safety in jet take-offs... or for successful emergency aborting... include the airspeed at which the aircraft takes off, the runway length and runway conditions, as well as computer measurement of the prime variables, distance traveled and indicated airspeed. Since indicated airspeed is measured directly rather than by inference from ground speed, no information as to field altitude, field temperature, wind force or direction is required.

The SMI monitor uses a vertical scale display that shows a plan view of the end of the runway, the continuously predicted actual point

of take-off, and the point where the aircraft would stop under maximum braking. The monitor may also be combined with the indicated airspeed display to conserve valuable panel space.

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